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W. S. Bayley

A summary of progress in mineralogy and petrography in 1891.

Geological Dept., Colby University.
Waterville, Me., 1892.

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From THE AMERICAN NATURALIST, February, 1891.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—Among the several brochures lately published explanatory of the new map of France, one by Lacroix[2] contains two articles. The first is descriptive of the metamorphic and eruptive rocks of Ariège, and the second is on the acid inclusions in the volcanic rocks of the Auvergne. In the former the marbles of Mercus and Arignac are carefully described. In them occur two varieties of humite, brucite, amphibole, phlogopite, scapolite, spinel, corundum, sphene, rutile, zircon, and many other less common minerals. One variety of the humite occurs in rounded crystals of a clear yellow color, that become colorless in thin section. The other variety is light orange, becoming golden yellow in the section. Both possess the same optical properties, except that the orange crystals are pleochroic in pale yellow and light golden-yellow tints. They are classed by the author with the clino-humites. Their alteration products are interesting. The most usual alteration is into brucite, found either in little plates, often several millimeters in length, or in fibres forming aureoles around unaltered cores of humite. Another alteration is into chrysotile. This is rare, and the change is usually incomplete. A third method of decomposition is into a granular mixture of secondary calcite, dolomite, and small grains of the original mineral. The amphibole in the rocks is pargasite. Two varieties of spinel were observed, one a violet and often transparent variety, and the other green pleonast. The violet spinel often accompanies the pargasite and humite. Both spinels are almost always surrounded by a circle of colorless chlorite in thin plates, and this in turn by a zone of secondary calcite and an outer rim of brucite. The rutile merits special attention, because what appears to be the ordinary black variety is found in thin section to be sometimes this, and sometimes like the violet rutile of the amphibole and pyroxene gneisses of Norway. The pyroxene and amphibole gneisses of this region and the wernerite gneisses present few peculiarities. The marbles, pyroxene gneisses, and granulites of St. Barthélemy are all marked by interesting features. The accessory components of the marbles are almost exclusively graphite, scapolite, pyroxene, and occasionally oligoclase, the last three forming rounded grains rarely surpassing a millimeter and a half in diameter.

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. des Serv. d. l. Carte. géol. d. France, No. 11, T. II.

The peridotite contains hypersthene and amphibole. Its olivine is perfectly fresh, and is in irregular grains imbedded in the amphiboloids. Some of the granulites contain corroded crystals of bright red andalusite, and also black tourmaline, sphene, muscovite, and garnet disseminated in a ground-mass of feldspar and quartz. Other granulites are very rich in cordierite, and these are in general less rich in quartz than are those bearing andalusite. Micaceous and quartzitic schists from the neighborhood of Ax embrace zircon, apatite, sphene, magnetite, and numerous other materials, thought to be due to the action of the granulite on the schists. On the granulite side of the contact this rock is found to be charged with andalusite, and often with cordierite. Pyroxenites consist of a colorless diopside, zoisite, garnet, calcite, occasionally quartz, and frequently vesuvianite, of which latter it is possible to isolate beautiful amber-yellow crystals of the variety egeran. In the second article by the same author is a discussion of the changes effected in acid inclusions by the basaltic and acid rocks of Auvergne. Two classes of these inclusions are recognized, viz., those found in lava streams, and those occurring in volcanic necks. Both classes include granites and gneisses rich in quartz, and frequently containing cordierite, sillimanite, garnet, corundum, diaspore, and zircon. The changes effected in them by the basic lavas varies in intensity, but not materially in kind. In extreme cases the inclusion has been entirely dissolved, with the exception of the insoluble substances, such as sillimanite, zircon, and diaspore, which remain as grains in the volcanic glass. The cleavages of the original feldspars have been accentuated, many liquid and gaseous inclosures have been developed in them, and the optical properties of the orthoclase have been changed. Quartz fragments in the altered forms have been surrounded by aureoles of augite. The new minerals developed in the surrounding rock by the solution of the inclusion are spinel, hypersthene, and sometimes labradorite, sometimes forming holocrystalline aggregates, and at other times occurring as individual grains bathed in a vitreous paste. In each case the minerals are met with only in the lava that has been injected between the components of the inclusions. They are not present in the magma enclosing them. The inclusions in the andesites and trachytes of the region are gneisses and kersantites. In most respects the changes that have been produced in them are analogous to those produced by the basalts. Much new feldspar has been generated in them, and this is usually optically continuous with the original feldspar to which it is attached. Tridymite is also an abundant new product, as are also spinel and hypersthene. All these minerals are produced in the inclusion; whereas in the case of the basaltic alteration the last two are found in the metamorphosed rock. In a later article Lacroix[3] summarizes the results of his study of inclusions, with reference especially to those of the Haute-Loire. When the inclusions are of the same composition as the enclosing rock, the former have in general been well preserved. If, on the contrary, the inclusion differs in its silica content from the surrounding rock, it is easily destroyed, merely traces of it remaining to mark its former presence.——Graywacke in contact with granite in the Lausitz, Saxony, is changed to knotty (Knoten) graywackes, in which muscovite, biotite, quartz, feldspar, and tourmaline occur as new products, and finally into a quartz-mica rock with cordierite, tourmaline, and some other new products. On the granitic side the rock has assumed a gneissic aspect, thought by Herrimann and Weber[4] to be the result of flowage.——The micro structure of several calcareous oölites from Iowa, and of siliceous oölites from Pennsylvania, is represented by Messrs. Barbour and Torrey[5] as concretionary in most cases, while in others the spherules have a brecciated or mosaic appearance. Analyses of several kinds ot oölites are given in the paper.

New Minerals.—*Castanite,* associated with barite occurs on a copiapite specimen from Sierra Gordo, Chili, in the form of large, brown, prismatic crystals, without well-developed faces. According to Darapsky[6] their streak is orange, hardness 3, and density 2.18. They are but slightly soluble in water or in cold hydrochloric acid, but easily dissolve in hot acid. Their composition ($SO_3 = 33.80$; $Fe_2O_3 = 33.92$; $H_2O = 30.76$; barite $= 1.15$) corresponds to $Fe\,(FeO)(SO_4)_2 + 8\,H_2O$. The crystallization is probably monoclinic.——*Manganopectolite* is associated with ozarkite and other decomposition products of elæolite-syenite at Magnet Cove, Ark.[7] On a fresh fracture the mineral is light gray and transparent. On its exterior it is covered with an opaque coating of brown manganese oxide. The crystals are bounded by $0P$, ${}_\infty\overline{P}_\infty$, $+2\overline{P}_\infty$ and ${}_\infty\overline{P}_\infty$, and their axial ratio is $a : b : c = 1.0731 : 1 : 4840$. Their habit is thick tabular. Cleavage is perfect, parallel to $0P$ and ${}_\infty\overline{P}_\infty$. Hardness $= 5$, and density 2.845. Composition:

SiO_2	Fe_2O_3	CaO	MnO	Na_2O	H_2O	CO_2
53.03	.10	30.28	4.25	8.99	2.43	.82

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[3] Bull. Soc. Franç. d. Min., XIII., 1890, p. 100.

[4] *Neues Jahrb. f. Min.*, etc., 1890, II., p. 187.

[5] *Amer. Jour. Sci.*, Sept., 1890, p. 246.

[6] *Neues Jahrb. f. Min.*, etc., 1890, II., p. 267.

[7] J. F. Williams. *Zeits. f. Kryst.*, XVII., 1890, p. 386.

Correcting for the small amount of calcite present, the analysis corresponds with the formula $(\frac{9}{10}\,Ca, \frac{1}{10}\,Mn)_2\,Na\,H\,(SiO_3)_3$—a pectolite with a tenth of its calcium replaced by manganese. In its optical properties the new mineral agrees well with the view that it is closely allied to pectolite. Its axial plane is $_{\infty}\overline{P}_{\infty}$, with *b* the acute bisectrix. The double refraction is positive, and the dispersion is strong $\varsigma > \rho$.——*Pinakiolite* and *trimerite* are both new minerals from the Manganese Mines in Sweden. The name of the first refers to its occurrence in small, tabular crystals. It was found by Flink[8] in granular dolomite at Langbanshyttan, associated with hausmannite. The density of the new mineral is 3.881, and its hardness is 6. It is soluble in strong hydrochloric acid with evolution of chlorine, and before the blowpipe it fuses with difficulty to a black bead. An analysis of the hydrochloric acid solution yielded :

B_2O_3	MgO	Mn_3O_4	Fe_3O_4	CaO	PbO	SiO_2	H_2O
15.65	28.58	49.39	2.07	1.09	.76	1.21	.47

Correcting for silica and water, the formula becomes R_3BMnO_6, or a manganese *ludwigite*. The black, lustrous crystals are usually orthorhombic, rectangular tables, in which the brachypinacoid is most developed. In addition to this there is present in the mineral only $_{\infty}\overline{P}\,3$. A definite termination of the *c* axis is lacking, but since twins with a brachydome as a twinning plane are common, the axial ratio was calculated with this as the unit form, and the following result obtained: $a : b : c = .83385 : 1 : .58807$. Cleavage is parallel to $_{\infty}\breve{P}_{\infty}$. The optical axial plane is oP, with *b* the negative acute bisectrix. The absorption is $B > A > C$, with $B = c =$ opaque ; $A = b =$ reddish-brown, and $C = a =$ reddish-yellow. *Trimerite* (τριμερής = three-fold) was found at the Harstigsgrube associated with frïedelite implanted on a fine-grained aggregate of magnetite, pyroxene, garnet, etc. The density = 3.474, and hardness = 6–7. The pulverized mineral dissolves in hot hydrochloric acid, with the separation of gelatinous silica. Its composition :

SiO_2	BeO	MnO	FeO	CaO	MgO
39.77	17.08	26.86	3.87	12.44	.61

corresponds to $(MnBe)SiO_4$, a manganese *phenacite*. The transparent bright red crystals have an hexagonal habit, due to twinning of triclinic individuals, whose triclinic nature is discoverable only by optical methods. In order to show their relations to the Willemite group the author describes the crystals in terms of the hexagonal system with $a : c = 1 : .7233$. They are thick, tabular forms, bounded by $0P$, $_\infty P2$, $_\infty P$, $\frac{3}{2} P2$, $\frac{3}{4} P2$ and $\frac{15}{8} P \frac{5}{4}$, and other pyramids with complicated symbols. Brögger finds that sections parallel to $_\infty P2$ extinguish at about 4° from c. $2V = 83° 29'$, with a very slight dispersion. The angles α, β and γ are all nearly 90°, so that the combination is somewhat similar to the combination of orthorhombic aragonites to produce an apparently hexagonal form. The axial ratio on the assumption of triclinic symmetry becomes $a : b : c = .5744 : 1 : .5425$, and the forms $0P$, $_\infty \breve{P}_\infty$, $_\infty P'$, $_\infty {}'P$, P', ${}'P$, $P_{,}$, ${}_{,}P$, $\frac{3}{4} P'3$, $\frac{3}{4} P\,3$.

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[8] *Zeits. f. Kryst.*, XVIII., 1890, p. 361.

Mineral Syntheses.—Boracite has been produced by Gramont[9] in the wet way. One part of borax and two of magnesium chloride were moistened with water and heated to 275°–280° in a sealed tube. Little crystals of the mineral thus obtained are bounded by tetrahedrons, octahedrons, and other forms apparently belonging to the regular system. Each tetrahedral face, however, is observed, upon examination, to be composed of small sectors, indicating a grouping of individuals of lower symmetry to produce a pseudo-regular form. When the mixture was heated at a temperature below 265° (the temperature at which natural boracite becomes isotropic) no boracite was obtained, but in its stead there resulted elongated hexagonal crystals of some substance not yet investigated.——One part of alumina and two of silica, according to Vernadsky,[10] unite at a white heat to form a glass which, under the microscope, is seen to be filled with little needles of sillimanite, with the composition : $SiO_2 = 37.31$; $Al_2O_3 = 63.65$. Porcelaine consists essentially of the same substances, viz., a glass holding acicular crystals of sillimanite.——Many of the most important zeolites have been manufactured by Doelter,[11] who at the same time has solved some of the problems as to their composition. His method of procedure was to dissolve suitable substances at moderately high temperatures under pressure, and allow them to cool gradually and crystallize. In this way he succeeded in making apophyllite, chabazite, heulandite, natrolite, and skolecite. The author next proceeded to investigate the composition of the minerals formed by heating some specimens to a temperature beyond which they lose water, occasionally examining them chemically and optically, and by fusing others and studying their decomposition products. At 260° apophyllite loses 19 per cent. of its water, and above this temperature is decomposed. Just below 260° the hydrate is biaxial, while above this temperature the anhydrous residue is uniaxial. Other zeolites yield similar results. These lead to the conclusion that they all consist of a nepheline, pyroxene, or feldspar-like silicate, combined with meta- or orthosilicic acid, and also an amount of water varying with the temperature. The crystal water may be driven off at high temperature, and taken up again at a lower one, and the various hydrates obtained by the successive steps may possess different crystallographic properties. After a certain amount of loss the minerals refuse to part with more water, which is regarded as chemically combined with silica in the silicic-acid portion of the combination. The author determines incidentally the solubility of several of the zeolites in different solvents, and concludes his paper with a table giving the supposed composition of the members of the group. Heulandite is represented as $CaAl_2Si_4O_{12}+2H_2SiO_3+3Aq$; natrolite as $Na_2Al_2Si_2O_8+H_4SiO_4$, etc.——Messrs. C. and G. Friedel,[12] by the action of lime on mica in the presence of calcium chloride, obtained small crystals of anorthite, and by the action of soda and sodium sulphate on the same mineral produced little prismatic crystals of a substance differing from nosean in the addition of two molecules of water.[13]

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[9] Bull. Soc. Franç. d. Min., XIII., 1890, p. 252.

[10] Ib., p. 256.

[11] *Neues Jahrb. f. Min.*, etc., I., 1890, p. 118.

Physical Mineralogy.—The discussion as to the cause of optical anomalies in uniaxial crystals has received another addition in a late article contributed by Martin,[14] in which the writer attempts to show that the Mallard theory with respect to these phenomena is faulty. Mallard believes that the crystals are pseudo-uniaxial; that they consist of several twinned individuals, which by their combination build up a form possessing a geometrical symmetry of higher grade than that belonging to its individual constituents. Martin has examined several organic compounds, and is thereby led to the conclusion that in these the anomalies are due to strain or pressure exerted on some parts of the crystal by the more rapid growth of other parts. It is well known that in many crystals a skeleton is formed first in the act of crystallization, and that this skeleton is subsequently filled in by the deposition of material within its arms. The skeleton thus grows faster than the interstitial substance, and exerts in this latter a strain whose effect is exhibited in the anomalies. Other important thoughts are brought out in the investigation, which appears to have been conducted in a careful and conscientious manner.——Wyrouboff,[15] in a reply to Martin's article, states that the latter's results differ but little from his own, and that the conclusions reached by him comprehend no new notions. ——The writer last referred to (W.) has recently[16] completed a series of experiments on circularly polarizing substances, by which he seems to have shown that the peculiar property of these bodies is due to their structure, which is described by Mallard as an irregular piling of very small biaxial plates. In this way a high grade of symmetry is imitated, while the plates are really of a low grade. He also adds a nineteenth substance to the list of rotatory polarizing bodies, viz., $(NH_4)LiSO_4$, which is apparently biaxial and positive.——The effect of temperature upon the optical and crystallographic constants of prismatic sulphur has been thorougly investigated by Schrauf,[17] who records his results in an excellent paper of fifty-nine pages. The first part discusses the values of the interfacial angles at different temperatures. The second is confined to refractive phenomena, such as the refractive index for different wave lengths. The third and fourth contain calculations of the values of the optical constants, and the fifth contains a discussion of the relations existing between the refractive indices and the wave length of the transmitted light, temperature, and other factors, and concludes with remarks on the constancy of the refractive and dispersive power, and upon the crystal form of prismatic sulphur.——A paper by Becke[18] on the etching of fluorite is a remarkable exhibit of careful and painstaking work in this branch of physical mineralogy. The author has subjected both natural and prepared faces of crystals from various localities to the action of acids and alkalies of various strengths and at different temperatures, and has studied the results produced. The symmetry of the figures obtained indicate a tetragonal symmetry for the mineral. Anomalous figures on some crystals, found only on planes that show double refraction, are explained as due to the manner of growth. Many new ideas are gathered from the study, one of the most important of which is embodied in a restatement of the law of symmetry of etched figures. These possess the symmetry of the face on which they occur only when this is a natural one free from striations, vicinal planes, etc. Experiments on the solubility of the mineral in different directions lead to the expression of a law of solubility as follows: The rapidity of solubility is equal along equivalent crystallographic directions, and different along unequivalent directions. Further, the author finds that elevations due to etching (aetzhügel) occur on faces least capable of resisting solution, while depressions (aetzgrübchen) are produced in the least soluble faces. Etching zones, he defines as those containing the planes with the greatest capacity for resisting solution. Many more results of interest are contained in the paper, the character of which is sufficiently indicated by the conclusions above referred to.——The natural etched figures on the topaz of San Louis Potosi, Mexico, correspond in symmetry with the faces on which they occur, with the exception of those on the brachypinacoid $2P\breve{\infty}$, which are unsymmetrical. According to Pelikan[19] they resemble the figures produced by Baumhauer upon treating the mineral with molten potassa.——Dufet[20] obtains 1.54421 as the value of the refractive index of quartz, based on the examination of seventeen different specimens of the mineral.

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[12] Bull. Soc. Franc. d. Min., XIII., 1890, p. 233.

[13] Ib., p. 238.

[14] *Neues Jahrb. f. Min.*, etc., B.B. VII., p. 1.

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[15] Bull. Soc. Franc. d. Min., XIII., 1890, p. 94.

[16] Ib., p. 215.

[17] *Zeits. f. Kryst.*, XVIII., 1890, p. 114.

[18] *Miner. u. Petrog. Mitth.*, XI., 1890, p. 349.

Miscellaneous.—The cosmic dust (kryokonite) collected by Nordenskjöld in Greenland, in 1883, has been submitted to Wülfing[21] for investigation, by whom it has been found to consist in greater part of feldspar, quartz, mica, and hornblende. There are present in it also garnet, zircon, magnetite, augite, and sillimanite, and with them is mixed a nitrogenous organic substance. The most interesting constituents of the dust are little chondri of opaque, isotropic transparent, and double refractive material. The larger part of the dust is thought to be a sediment from the air, and to have been obtained by it from a region of crystalline schists. The chondri, on the other hand, are thought to be of cosmic origin, since they are similar to the chondri obtained in deep-sea soundings. If the amount of the dust collected from the snow in Greenland represents the fall of one year, the total amount falling upon the entire surface of the earth in this time is 125 million kilograms, equivalent to a cube of thirty-one yards on a side.——A new crystal refractometer has been devised by Czapski.[22] Its construction and use is carefully described by the inventor in a recent paper in the *Neues Jahrbuch.*——That a definite relation exists between the habits of crystals of certain minerals and their mode of formation has long been recognized, but it has been left for Arzruni[23] to undertake a systematic study of this relation. In a late paper this writer communicates the results of the examination of crystals of hematite produced by sublimation in smelting furnaces and those from San Sebastiano, Italy, that are supposed to have been formed in an analogous manner. In all of these the habit is the same, although different combinations of nearly related forms occur on them. Sublimed valentinite and senarmontite are likewise studied. Cuprite produced by slow oxidation at a low temperature has an octahedral or dodecahedral habit, while that produced at a high temperature is probably hexahedral. Struvite obtained from a solution of Koch's peptone differs materially from the natural mineral, but the differences have not yet been carefully enough studied to warrant any general conclusion being drawn from the observations. Further articles from Prof. Arzruni will be looked for with interest.

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[19] Ib., XI., 1890, p. 331.

[20] Bull. Soc. Franc. d. Min., XIII., 1890, p. 271.

[21] *Neues Jahrb. f. Min.*, etc., B. B., VII., p. 152.

[22] *Neues Jahrb. f. Min.*, etc., B. B., VII., p. 175.

[23] *Zeits. f. Kryst.*, XVIII., 1890, p. 44.

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MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The protogine of Mont Blanc is shown by Lévy[2] to be a true eruptive, apophyses from which penetrate the surrounding schists and alter them, and break from them fragments which they hold as inclusions. These fragments have been regarded as basic segregations, and the surrounding schists have been looked upon as dynamo-metamorphosed phases of the protogine. Both of these views the author combats. Among the schists he finds eclogites, with diopside in micropegmatitic intergrowths with quartz and feldspar, amphibolites and mica-schists, each of which classes is briefly described. The segregations mentioned occur most frequently near the contact of the granite with the schists. Many of them resemble so closely certain phases of the schists that Lévy is compelled to regard them as fragments of these caught up by the eruptive during its passage from below. A microgranite from the periphery of the main mass of granite consists of corroded crystals of the first generation cemented by a granitic ground-mass. This fact is thought to be an indication of the correctness of the view that the constituents of granite are mainly of the second generation, those of the first consolidation having disappeared. To the southeast of Mont Blanc are quartz-porphyries which, according to Graeff,[3] are genetically related to the granite composing the body of the mountain. Like the latter, the porphyries have been subjected to pressure, by which process much sericite has been developed, resulting in sericite-schists. The present contact of the eruptives with the gneisses and mica-schists of the Mont Blanc "massif" is thought not to be an original contact, but one brought about by dislocations. The conclusions of Lévy and Graeff are thus seen to be in accord in some particulars, while in others they are at variance. Fuller discussions are promised later.——In the first part of a general sketch of the geology of the Japanese Islands Harada[4] gives short descriptions of Archean gneisses and schists, and of eruptive rocks of more recent age. Among the schists are mentioned graphitic sericite-schists, with well-developed crystals of tourmaline and hematite, and a chloritic amphibolite whose principal feldspar is albite. Gabbros and peridotites cut the Paleozoic strata. In some specimens of the former piedmontite was noticed as an alteration product of hornblende. In the Mesozoic occurs the largest quantity of eruptives. Granite and diorite in many varieties cut through the sedimentary rocks, and change them near the contact into hornstones holding cordierite and ottrelite. In sericite-gneiss garnets are produced, in amphibolites andalusite is a new product, and in limestone wollastonite and garnet result from the contact action. The eruptives, on the other hand, become coarse-grained and porphyritic near the contact, the diorite losing hornblende and gaining quartz and orthoclase, until it finally resembles a granite. Among the effusives of this age are mentioned quartz-porphyries and porphyrites.——Weinschenck[5] communicates additional information with respect to the rocks of these islands, as a result of the study of some hand specimens. Most of the sections examined by him are of a hypersthene andesite, with a plagioclase full of inclusions, and a pleochroic monoclinic pyroxene which sometimes forms intergrowths with hypersthene. Among the rocks from the extinct volcanoes is a bronzite trachyte containing biotite, garnet, and tridymite in a ground-mass of the same minerals and zircon, in a trichitic glass. The most interesting rock of the series bears the same relation to the andesites as the augitites do to the basalts. It consists principally of acicular crystals of bronzite in a ground-mass consisting of clear glass and magnetite grains, with porphyritic plagioclase and garnets. The author calls the rock *sanukite*, from the province in which it is found.

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. des Serv. d. l. Carte. gèol. d. la France, No. 9, 1890.

[3] Archiv. des Sciences phys. et nat., Nov., 1890.

Mineralogical News.—The regular silicates are very few in number, and of them eight are orthosilicates,—viz., ***eulytite***, ***zunyite***, ***helvite***, ***danalite***, ***garnet***, ***sodalite***, ***nosean*** and ***hauyne***, and ***lasurite***. These Brögger and Backström[6] would include in one group, which they would call the garnet group. The members of this group is divided into two sub-groups, in one of which the tetrahedral habit is predominant and the cleavage is octahedral. This includes the first four minerals mentioned above, and is known as the helvite group. All its members can be represented by formulas of the garnet type. Helvite may be written $(MnFeCa)_2(Mn_2S)Be_3(SiO_4)_3$, danalite as $(FeZnMn)_2[(ZnFe)_2S]Be_3(SiO_4)_3$, zunyite as $[(OH)_9Fe_2ClAl_6](SiO_4)_3$, and eulytite as $Bi_4(SiO_4)_3$. The second sub-group includes the species with with dodecahedral habit and cleavage. Embraced in this is the garnet series proper, with a composition $R_3^{II} R_2^{III} (SiO_4)_3$, and the series of the alkaline garnets. The etched figures on the latter indicate that they are all tetrahedrally hemihedral, and a discussion of the best analysis of them leads to the conclusion that they are all of the chemical type of common garnet. Sodalite is $Na_4(AlCl)Al_2(SiO_4)_3$ and nosean is $Na_4[Al(NaSO_4)]Al_2(SiO_4)_3$. In hauyne, calcium replaces some of the sodium in nosean. Lapis-lazuli, or natural ultramarine, is a mixture of several minerals, of which one is bright blue. The authors have isolated this and found it to contain:

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[4] Die Japanischen Inseln., 1st Lief., Berlin, Parey, 1890.

[5] *Neues Jahrb. f. Min.*, etc., B. B. VII., p. 133.

[6] *Zeits. f. Kryst.*, XVIII., 1890, p. 209.

SiO_2	Al_2O_3	CaO	Na_2O	K_2O	SO_3	S	Cl
32.52	27.61	6.47	19.45	.28	10.46	2.71	.47

Upon the assumption that this is a mixture of hauyne, sodalite, and ultramarine, it is calculated that the latter substance must be represented by the formula $Na_4[Al(S_3Na)]Al_2(SiO_4)_3$. The authors then discuss the nature of artificial ultramarine, and conclude that it is a mixture of five isomorphous substances. A microscopical examination of lapis-lazuli reveals the fact that in all cases this is a mixture of several substances, among which may be mentioned hauyne, diopside, kokscharowite, calcite, pyrite, and a muscovite-like mineral, together with a little scapolite, plagioclase, orthoclase, apatite, sphene, zircon, and an unknown, probably positive, uniaxial mineral.——The interesting Chilian minerals continue to be subjects of investigation to those who are fortunate enough to come into possession of them. Frenzel[7] describes briefly a few of the rarer among them. *Sideronatrite*, with a yellow color and a metallic lustre, has a density of 2.31, and a composition as follows:

$$\begin{array}{cccc} SO_3 & Fe_2O_3 & Na_2O & H_2O \\ 42.93 & 22.86 & 17.49 & 15.66 \end{array} = 2Na_2SO_4+Fe_2S_2O_9+6H_2O$$

The mineral is from Sierra Gorda, near Caracoles. It is identical with the Peruvian sideronatrite described by Raimond,[8] which, however, was regarded by him as possessing but one molecule of Na_2SO_4 to one of the iron sulphate. It is probably an alteration product of ***hohmannite***, occurring associated with it, and found also in the Sierra de la Caparrosa, as brownish-red, glassy plates and crystals, often arranged in radial aggregates. Their hardness is 3, and specific gravity 2.17.

[7] *Miner. u. Petrog. Mitth.*, XI., 1890, p. 214.

[8] *Zeits. f. Kryst.*, 1882, VI., p. 627.

They remain unchanged in the air, and have the same composition as amarantite and the specimens of hohmantite[9] analyzed a short time since,—viz., $Fe_2S_2O_9 + 7H_2O$. Various other minerals from the same region are briefly alluded to in this paper, and two new ones (quetenite and gordaite)[10] are described. Messrs. Genth and Penfield[11] have examined some of these species in more detail. The material in their possession is from the Mina de la Campania, near Sierra Gordo. ***Amarantite*** is found to be triclinic with $a : b : c = .76915 : 1 : .57383$ $\alpha = 95° 38' 16''$, $\beta = 90° 23' 42''$, $\gamma = 97° 13' 4''$. The habit of the crystals is prismatic. The brachy, and macropinacoids are vertically striated, and a perfect cleavage is parallel to each. The optical angle $2E_{na} = 63° 3'$, and the extinction in the macropinacoid is 16°–17°, in acute β. Fibres of ***sideronatrite*** show a slight pleochroism, with a pale straw-yellow color parallel to the longer axis, and no color at right angles to this. The formula ascribed to the substance differs from Frenzel's formula in lacking one molecule of water. ***Ferronatrite***, although obtainable only in white or grayish cleavage masses, is thought to be hexagonal. Its indices of refraction are $\omega = 1.558$, $\varepsilon = 1.613$, and its composition is $SO_3 = 51.30$; $Fe_2O_3 = 17.30$; $Na_2O = 19.95$; $H_2O = 11.89$; specific gravity $= 2.547–2.578$. Darapsky[12] also gives a few notes of observations on a few of the minerals from Atacama. Among these are ***aromite***, ***paposite***, ***amarantite***, ***hohmannite***, ***coquimbite***, ***fibroferrite***, ***nebrite***, ***botryogen***, ***thenardite***, ***quartz***, and ***halite***.—— Bauer[13] describes the first interpenetration twin of ***tourmaline***, from an unknown locality. The twinning plane is R, and the forms observed in the individuals are ∞P2 and—2R. A pseudomorph of ***aragonite*** after calcite, from Müsen in Siegen, is one of the few instanesc described in which the latter mineral is known to have changed into the former one. They consist of shells of calcite enclosing a white granular calcite holding crystals of barite and snow-white aragonite. These fill two-thirds of the space within the shell, the remaining one-third being hollow. The pseudomorph is supposed to be due not to the molecular replacement of the calcite, but to solution of the interior of the crystal and subsequent deposition of calcium carbonate from calcium-bearing solutions containing traces of Barium. By experimentation Bauer has found that barium bearing calcium carbonate solutions deposit crystals with the properties of aragonite. The crystals of *lievrite*, from Dillenburg, Nassau, fall into two classes. The first includes well-developed prismatic forms with large macrodomes ($\bar{P}\infty$) on both terminations. The others are prismatic with $\bar{P}40$ and $\bar{P}\frac{28}{35}$ on one termination. The other is attached to the gangue. Their axial ratio is .6795 : 1 : .4576. In the article by Messrs. Genth and Penfield[14] referred to above appear analyses of *picropharmacolite* from Joplin, Mo., of a substance supposed to be ——— from near Georgetown, N. M.; of *pitticite* from the Clarissa Mine, in the Tintic District, Utah; and of *gibbsite* from White Horn Station, Chester Co., Pa. The last-named mineral is discovered to be a hydrous aluminium phosphate. The pitticite corresponds in composition to $4Fe_2As_2O_8\ Fe_2(OH)_6+20H_2O$.——The remarkable mineral locality, Branchville, has again been reported upon by Messrs. Brush and Dana.[15] During the ten years that have elapsed since their previous report[16] extensive mining has been carried on at the locality for the purpose of obtaining quartz and microcline for technical uses. During the past two years large quantities of rare magnesian phosphates have been brought to light, and these have been investigated by the mineralogists mentioned. The minerals whose indentification is recorded are *lithiophilite*, *hureaulite*, *reddingite*, *fairfieldite*, *dickinsonite*, and *fillowite*. The lithiophilite is in rudely crystalline masses in a vein, associated with albite, quartz, and spodumene. It is, as a rule, fresh. Occasionally it is extensively altered into hureaulite through the intermediate product dickinsonite. The succession in age of its various decomposition products, among which are all the other minerals mentioned above, could not be determined, as they seem to occur together promiscuously. The hureaulite, heretofore known only at Limoges, France, is in small monoclinic crystals, varying in color from violet to orange red, and united into parallel aggregates. Their axial ratio is $a : b : c = 1.9192 : 1 : .5245$ with $\beta = 84^\circ\ 1'$, on the assumption of the plane $\frac{4}{5}\bar{P}\frac{4}{3}$, determined by Descloizeaux in the Limoges crystals as the ground form. The habit of the Branchville crystals is short prismatic, with $\infty\bar{P}\infty$ and various pyramids well developed. The crystals have a good cleavage parallel to the orthopinacoid, a specific gravity of 3.149, and a composition as follows:

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[9] *Miner. u. Petrog. Mitth.*, IX., p. 397.

[10] AMERICAN NATURALIST, Dec., p. 1190.

[11] *Amer. Jour. Sci.*, Sep., 1890, p. 199.

[12] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 49.

[13] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 10.

P_2O_5	FeO	MnO	CaO	H_2O	Quartz.
38.36	4.56	42.29	.94	12.20	1.76

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[14] *Amer. Jour. Sci.*, Sep., 1890, p. 199.

[15] *Amer. Jour. Sci.*, Mch., 1890, p. 201.

[16] Ib., 1880, p. 257.

corresponding to $H_2(MnFeCa)_5PO_4+4H_2O$. Reddingite is in pinkish-white masses, and in orthorhombic crystals with an octahedral habit. The axial ratio is $a:b:c=.8678:1:.9485$, and density 3.204. Their analysis yielded Mr. Wells:

P_2O_5	FeO	MnO	CaO	H_2O	Quartz.
34.90	17.13	34.51	.63	13.18	.13

a result expressed by the formula $(FeMn)_3(PO_4)_2+3H_2O$. Fairfieldite is in transparent foliated masses of a whitish or greenish-white color and a brilliant lustre, inclining to pearly on the perfect cleavage. Its composition agrees with the symbol $Ca_2Mn(PO_4)_2+2H_2O$. Dickinsonite is a bright green chlorite-like mineral with a micaceous structure and rhombic tabular habit.——The beautiful *chalcopyrite*[17] crystals from the French Creek Mines, Chester Co., Pa., occur together with pyrite[18] imbedded in byssolite, thuringite, and calcite in pockets in a magnetic iron ore. The principal type of the chalcopyrite is the sphenoid $\frac{\frac{1}{2}P}{2}$ often modified by a scalenohedron. All the faces are striated, and frequently they are so much rounded as to preclude measurements of their interfacial angles. Twinned crystals are quite common, the combination possessing an hexagonal habit.——The rare zeolite *mordenite* has been discovered by Pirsson[19] in the cavity of an amygdaloidal basalt, forming fragments in a breccia near Hoodoo Mt. in Western Wyoming. The mineral is in very small crystals, with a specific gravity lying between 2.119 and 2.179. Their analysis yields:

SiO_2	Al_2O_3	FeO_3	CaO	MgO	K_2O	Na_2O	H_2O
66.40	11.17	.57	1.94	.17	3.58	2.27	13.31

which is equivalent to $3RAl_2Si_{10}O_{24}+20H_2O$, in which R represents potassium, sodium, and calcium. The mineral differs from ptilolite in containing more water. In crystallization it is monoclinic, and is isomorphous with heulandite. Its habit resembles that of beaumontite. $a:b:c=.4010:1:.4262$, $\beta=88°\ 30.5'$. The plane of the optical axes is perpendicular to $\infty P\grave{\infty}$, and the extinction on this face is 15° to the clino-axis.——A careful examination of the *apophyllite* of the Seiser Alps indicates to Ploner[20] that the differences in the lengths of the crystallographic axes of specimens of the minerals from different localities, and occasionally even in different parts of the same individual, are due to variations in the positions of planes to which identical symbols have been given. The new forms detected on the crystals examined are $\frac{1}{10}P$, $\frac{1}{5}P$, $\frac{2}{7}P$, ∞P, $P\infty$, $\frac{5}{3}P\infty$, $\frac{1}{2}P\frac{3}{2}$, $3P\frac{3}{2}$, $\infty P2$, and $\infty P3$, making ninety-seven forms now known to occur in the species.——Baumhauer[21] has discovered some small but good crystals of *cryolite* in a hand specimen from Evigtok, Greenland, so twinned that both individuals have their basal planes in common, and one appears to have been revolved about 88° 2′ around an axis normal to the base. ——The limestone of Villefranque and of Biarritz, France, contains long needles of quartz and crystals of dipyr and albite,[22] the first of which must have been formed contemporaneously with the limestone, while the last two were produced by the influence of an intrusive mass of diabase upon the enclosing rock.——Traube[23] ascribes the differences in the values of the axial ratios of different *sheelites* to the amounts of molybdenum occurring in them. Analyses of many specimens reveal the fact that white and light yellow varities contain but little of this element, while the dark varieties contain quite large amounts, (1–8%). The axial ratio of the purest scheelite is 1 : 1.5315, that of calcium molybdenate is 1 : 1.5458, and that of most scheelites between these limits.——In the pegmatite veins cutting granite near Meissen, Saxony, Sauer and Ussing[24] have found Baveno twins of *microcline* in which the gridiron structure is lacking. Lamellæ of albite are intergrown with the microcline, but sufficiently large areas of the latter mineral were found to allow of careful measurements of cleavage, angles, etc. The angle between the cleavage lines is 89° 30′, and the refractive indices for sodium light.$\alpha = 1.5224$, $\beta = 1.5264$, $\gamma = 1.5295$. The optical angle is $2V = 83° 41'$.——A pure white *zinc sulphide* is mentioned by Mr. Robertson[25] as occurring at Galena, Cherokee Co., Kansas. It is associated with sphalerite, and is in a form suggesting the moist, freshly prepared substance. It is saturated with water bearing a trace of sulphuric acid. Its composition is: $Zn = 63.70$; $S = 30.77$; $Fe_2O_3 = 2.40$; Insol. = 2.52.——Rinne[26] gives some good illustrations of *microcline* structure in the feldspar of the Stockholm granite and of the Kyffhäuser gneiss, and suggests reasons for regarding it as a secondary phenomenon produced in non-striated feldspar.——The *phenacite* reported by Mr. Yeates[27] from

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[17] Penfield. *Amer. Jour. Sci.*, Sep., 1890, p. 207.

[18] Penfield. Ib., III., XXXVII., p. 209.

[19] Ib., Sep., 1890, p. 232.

[20] *Zeits. f. Kryst.* XVIII., 1890, p. 337.

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[21] Ib., XVIII., 1890, p. 355.

[22] Beaugey. Bull. Soc. Franc. d. Min., XIII., Feb., 1890, p. 59.

[23] *Neues Jahrb. f. Min.*, etc., B. B. VII., p. 232.

[24] *Zeits. f. Kryst.*, XVIII., 1890, p. 192.

[25] *Amer. Jour. Sci.*, Aug., 1890, p. 161.

[26] *Neues. Jahrb. f. Min.*, etc., 1890, II., p. 66.

[27] *Amer. Jour. Sci.*, Sep., 1890, p. 259.

Hebron, Me., turns out upon analysis to be apatite with a tabular habit.

New Minerals.—A new borate has been discovered imbedded in the form of small, colorless, transparent, or milky-white crystals in the pinnolite of Stassfurt, Germany. The crystals are monoclinic, with two perfect cleavages perpendicular to the plane of symmetry. One of these is assumed as the base, and the other as the orthopinacoid, when the axial ratio becomes $a:b:c = 2.1937:1:1.73385$; $\beta = 80^\circ 12'$. The forms observed are $\infty P\bar{\infty}$, ∞P, $-P$, $\frac{1}{2}P$, $\bar{P}\infty$, and $-3\bar{P}3$. Hardness is 4–5; density, 2.127. The plane of the optical axes is perpendicular to the plane of symmetry, and makes with c an angle of $^\circ 7$ in acute β. $A = b$. $2H_{na} = 104^\circ 27'$. The composition of the substance, as found by Baurath, is:

B_2O_3	MgO	K_2O	Na_2O	Cl	H_2O
52.13	13.80	8.14	.39	.35	23.83

which corresponds to $H_4Mg_2K(BO_2)_9 + 6H_2O$. The name Hintzeite has been given it by Milch.[28] The same mineral is described under the name Heintzite by Leudecke.[30] According to this investigator, the mineral is easily soluble in hydrochloric and nitric acids. An analysis yielded results different from those above given, as follows: $B_2O_3 = 60.53$; $MgO = 12.23$; $K_2O = 7.39$; $H_2O = 19.85$. The axes chosen by Leudecke have the ratios $a:b:c = 1.2912:1:1.7572$ $\beta: 57^\circ 41' 4$. The principal cleavages are thus parallel to $0P$ and to $\frac{1}{2}\bar{P}\infty$. The refractive index for sodium light vibrating parallel to A is 1.354. The other optical properties coincide with those determined by Milch. Prof. Groth suggests that neither of the two names suggested for the mineral be accepted until it is found which analysis is correct.——*Powellite.*—In a weathered fragment of bornite from the Devil's Mining Region, in Idaho, Mr. Melville[30] has discovered a mineral resembling scheelite in external appearance, but differing from it in composition. The crystals are small, prismatic, greenish-yellow in color, with a hardness of 3.5, and a density of 4.526. They have a resinous lustre, and are semi-transparent and brittle. Measurements of angles indicate a tetragonal symmetry with $a:c = 1:1.5445$. The planes appearing $0P$, P, $P\infty$, and ∞P. The composition is:

MoO_3	WO_3	SiO_2	CuO	MgO	Fe_2O_3	Al_2O_3	CuO	S
58.58	10.28	3.25	25.55	.16	1.65	tr.	tr.	und.

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[28] *Zeits. f. Kryst.*, XVIII., 1890, p. 479.

[29] Ib., p. 481.

[30] *Amer. Jour. Sci.*, Feb., 1891, p. 141.

The mineral bears the same relation to calcium molybdate as scheelite does to the corresponding tungstate.——An isotropic or weakly doubly refracting mineral occurs in the nepheline-syenite of a "massif" in the Kole Peninsula, Russia. Since its properties have not yet been fully determined, its discoverer, Ramsay,[31] has not yet assigned to it a name. The mineral is red and transparent. It fuses easily, and yields water. It is attacked by acids with difficulty, has a low index of refraction, $n_{na} = 1.5223$, and possesses no cleavage. Its density is 2.753, and composition:

SiO_2	$Al_2O_3Fe_2O_3$	MnO	CuO	MgO	Na_2O	K_2O	Loss
55.88	15.19	2.67	9.53	.53	9.06	1.57	6.04

——*Leverrierite*[32] occurs in small pseudohexagonal prisms that are twinned orthorhombic forms with a prismatic angle of 128°. They have a very perfect cleavage parallel to oP, so that they may easily be mistaken for mica. Often the prisms are twisted so that they resemble worm tubes to such perfection that they have been mistaken for organic markings, and have been described under the name *bacillarites*. According to Termier, all specimens of bacillarites examined by him are prisms of the new mineral, whose composition is $H_{10}Al_4Si_5O_{21}$. The hardness of the substance is 1.5, and its density 2.3–2.4. The plane of its optical axes is $\infty\bar{P}\infty$, with a negative acute bisectrix normal to oP and an optical angle $2V = 45°–52°$. It may be distinguished from muscovite by its dark color, and from biotite by its weak pleochroism, and its weak double refraction. Leverrierite is found as a metamorphic constituent in carbonaceous clay slates, and in interstratified carboniferous eruptives.

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[31] Ref. *Neues Jahrb. f. Min.*, etc., 1891, I., p. 98.

[32] Bull. Soc. Franc. d. Min., XIII., 1890, p. 325.

From the AMERICAN NATURALIST, June, 1891.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—Mount Aviólo, in the southern Alps, consists in part of tonalite and in part of a quartz-mica-diorite, both of which intersect a series of crystalline schists, in which contact alteration has been effected. The tonalite is the rock so well known as comprising a large part of the Adamello group of the Alps. It is essentially a hornblendic quartz-mica-diorite. A garnetiferous variety is described by Salomon[2] as an endomorphous contact product. It is characterized by the possession of plagioclase zonally developed, with the most acid zones on the exterior. The extinction of crystals varies as much as 30°, being by this much greater in the nucleus than in the peripheral portions. The quartz-mica-diorite forms a boss only two kilometers distant from that of the tonalite, but it is regarded by the author as having no genetical relation with the latter. These two masses of eruptives are surrounded by two series of schists: a younger series including phyllites and epidote-amphibolites, and an older one embracing gneiss and mica-schists. The former are in contact with the diorite, by which they have been changed into rocks composed essentially of quartz, muscovite, biotite, chlorite, and andalusite, of which the biotite and andalusite are new products. Corundum, tourmaline, sillimanite, and zircon are also new products, but are present only in small quantity. A cordierite-biotite rock, consisting of these minerals together with quartz, was found as an inclusion in the diorite. According to the degree of alteration effected in them the rocks are separated into two zones: an outer one, the zone of the ilmenite-frucht-schiefer, in which the phyllites have suffered merely the change of their chlorite into biotite, and an inner zone, in which andalusite is an important constituent. The schists around the tonalite belong to the older series of gneiss and mica-schists. These have been more completely metamorphosed than the members of the phyllite series, for in addition to andalusite there is an abundant development of cordierite in them, where they approach the eruptive. As in the case of the diorite contact belt, there have also been recognized in the belt surrounding the tonalite two distinct contact zones. In the outer one the normal gneiss and mica-schists have been changed into cordierite and andalusite varieties, containing a fibrous orthoclase. In the inner zone all resemblance to gneiss and mica-schists has disappeared, and the rocks have become aggregates of cordierite, andalusite, plagioclase, sillimanite, tourmaline, garnet, spinel, corundum, and zircon. The replacement of the orthoclase of the outer zone by plagioclase in the inner one indicates a difference in the composition of the two belts, but this is thought not to be a result of more intense metamorphism, but as due rather to a difference in the composition of the original materials. The cordierite in these rocks is colorless and non-pleochroic, but it becomes brown and pleochroic on heating. It often twins parallel to ∞P, and alters readily to a pinnite-like substance. The other constituents possess no unusual peculiarities. They are all well described, but none are analyzed. Dykes of porphyrite cut the schists, and a single one occurs in the tonalite, but none of them merit special mention in this place.——The most valuable contribution to the study of the crystalline schists that has appeared for some time is entitled "The Greenstone-Schist Areas of the Menominee and Marquette Regions of Michigan." In it the author, Dr. G. H. Williams,[3] discusses the origin of the crystalline schists found so widely spread over the country bordering on Lake Superior. The paper opens with an excellent historical review of the recent work on crystalline schists in Europe, in which all the important articles on dynamically formed schists are abstracted. This chapter, together with the foot-notes accompanying it, form a splendid résumé of the present state of our knowledge on this subject, and is well worthy the study of all geologists, particularly of those who still hold to the belief that all schistose rocks were originally laid down as sediments. In the special part of the volume the author describes the present features of the green schists of Michigan, and shows conclusively that these were once igneous rocks, often volcanic flows, sometimes tufas, in which foliation and mineral changes have been produced by dynamic agencies. The rocks from which the schists were formed were diabases, diabase-porphyries, diorites, and gabbros among the basic types, and granites and quartz-porphyries among the acid types. The resulting types are chlorite and hornblende-schists, granulites, gneisses and porphyroids, sericite-schists, and other foliated rocks. An important part of the study is that embracing the discussion of the effects of pressure upon the mineral constituents of the original rocks, and of the new structures produced in the secondary rocks. The new minerals formed during the production of the schists are albite, microcline, zoisite, garnet, quartz, hornblende, epidote, biotite, muscovite, sericite, rutile, anatase, and sphene. Each of these is carefully described, and the conditions under which it was formed are carefully examined. The genesis of the schistose structure is finely worked out, both macroscopically and microscopically, and the mineral change that accompanies the development of the foliation is well shown. A large body of green schists is thus proven to have been developed by pressure from massive rocks, just as the gabbro-diorites were formed from gabbros in the Baltimore region. There are many interesting features of the Michigan schists that might be dwelt upon at some length did space permit, and many important mineralogical metamorphoses might be referred to. But no review, however full, can do more than suggest the outline of the bulletin. It must be read to be understood. The many good maps and illustrations and the nine lithographic plates of rock structures render great aid to the reader. It is evident that the schists of Michigan cannot grade into the overlying fragmentals, and since they are much more squeezed than these, that they cannot be of the same age.——An important communication, bearing upon the relation existing between dyke rocks and their corresponding plutonic facies, has lately appeared under the names of Hunter and Rosenbusch,[4] who have discovered that one of the rocks occurring in dyke form in the elæolite-syenite region of the Serra de Tinguá, Brazil, is a new type, which may be regarded as the equivalent of the plutonic elæolite-syenite. The rock has been called trachyte, phonolite, and basalt by various writers, but the present authors have decided to give it a distinctive name, "monchiquite," from the locality in Portugal from whence the type was first described. The rock belongs among the camptonites. It is of a dark color, and is composed of a dense ground-mass holding small phenocrysts of amphibole, pyroxene, mica, and olivine. Carefully examined, the ground-mass is found to be a colorless glass containing microlites of the same minerals as occur in the phenocrysts, and occasionally a few laths of plagioclase. The glassy base has a composition that indicates a close relationship with elæolite-syenite:

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] *Zeits. d. deutsch. geol. Ges.*, XLII., 1890, p. 450.

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[3] Bull. No. 62, U. S. Geol. Survey.

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[4] *Miner. u. Petrog. Mitth.*, XI., 1890, p. 445.

	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	H_2O	CO_2
Rock	46.48	.99	16.16	6.17	6.09	4.02	7.35	5.85	3.08	4.27	.45
Base	53.43		20.86	2.61		.29	1.14	11.63	2.51	7.06	

But little interest attaches to the components of the rock. The hornblende and augite are often zonally developed. In the former the kernel shows evidence of having been corroded, while the external envelope never exhibits sign of such resorption. Analyses of one variety of the augite and of the hornblende appear in the paper. The latter mineral contains 3.37 per cent. of K_2O.——As the result of a microscopic study of the "Weissenberg gneiss," in Saxony, in which cordierite and other characteristic contact minerals were discovered, Weber[5] pronounces the rock a member of the graywacke series that has been metamorphosed by the Lausitz granite.—The basalt of Royat (Puy-de-Dome) contains geode-like cavities lined with calcite and other minerals. Calcite also fills crevices and holds fragments of the rock torn from the sides of the clefts. In some of these fragments are crystals of feldspar with the morphological and optical properties of orthoclase, but with a large proportion of sodium in its composition ($SiO_2 = 66.83$; $Al_2O_3 = 19.20$; $CaO = .06$; $K_2O = 6.29$; $Na_2O = 6.8$).[6]——Zirkel[7] has determined the small hexagonal crystals in the altered sandstone of Steinberg, in the Habichtswald, Germany, to be cordierite, produced probably by the solution of the interstitial substance of the sandstone by basalt.——Termier[8] notes the occurrence of veins of orthoclase and quartz in the silicified Carboniferous schists of Saint-Étiénne, whose structure is neither micropegmatitic nor microgranulitic, though both minerals were deposited simultaneously from the same mother-liquor. He also describes briefly a silicified schist consisting of bands of opal and chalcedony, from the Butte of Montraynand.——Quartz-twins occur porphyritically developed in the pumice of Cobo de Gata.[9]

Miscellaneous.—Offret[10] has recently published a very exhaustive account of some investigations upon the effect of various temperatures upon the indices of refraction of several minerals, for every color in the visible spectrum. His paper opens with an historical review of the work already published. Then follows a very full description of the methods used in his investigations, and of the apparatus employed. A thorough discussion of the limitations of his methods covers about a hundred pages. After showing that the results obtained by the method used, which is that of the prism, are quite accurate, he records his measurements upon calcite, beryl, phenacite, aragonite, barite, cordierite, two topaz crystals from different localities, orthoclase, and oligoclase, at temperatures up to 330°. In two tables, appended to the statements of general results reached in each case, are given the indices of refraction for six differently colored rays moving along the several axes of elasticity in each mineral, and under different conditions of temperature: (1) as measured in warm air, (2) as calculated for a vacuum. A third table contains the values of the double refraction calculated for a vacuum, and a fourth represents the variations in the angle of the prism used produced by different temperatures. Without entering into the details of the investigation, it may be said that the figures reached by the author are worthy of the greatest confidence, and that when differing from those obtained by other observers they must be accepted in place of these latter. Among the most interesting of the general results obtained are the following: Of the minerals examined only barite and aragonite show a refractive index decreasing with an increase in temperature. There is a general increase in the value of the optical angle and in the dispersion of the axes, with increase in temperature. The double refraction increases with the temperature only in the case of beryl. Brazilian topaz is the only mineral showing a decrease in the amount of double refraction, in passing from red to violet light. Other points of interest brought out in the work are too numerous for mention here. The paper covers two hundred and eighty-seven pages.——In a recent communication Behrens[11] gives a very valuable synopsis of microchemical methods, applicable not only to the determination of the constituents of minerals in thin sections of rocks, but useful also as aids to the blowpipe in determinative mineralogy. His article opens with a few introductory remarks on manipulation. Then follows a résumé of the tests that have given most satisfaction in the detection of fifty-nine of the elements. These are arranged alphabetically, and under each are given the directions for making the tests selected.——Wyrouboff[12] proposes a new theory for the explanation of polymorphism, and shows how this may include also the explanation of pseudo-symmetry. His paper, which is a very clear exposition of his views, opens with the account of his understanding of the differences between polymerism, polymorphism, and pseudo-symmetry. The first he regards as purely chemical, and as not affecting in any way the arrangement of particles in crystals. It has to do merely with the molecules, while polymorphism has to do with the crystal particles.[13] The molecules unite according to certain definite laws, yielding the crystal particles, which may exist even in solution, when they may reveal themselves by their effect upon polarized light. The crystal particles are in their turn disposed regularly to form the crystal. When this disposition is identical with that of the molecules in the crystal particles a symmetrical body results. When the arrangement of the particles is different from that of their constituent molecules the body is pseudo-symmetrical. The various forms of a polymorphic body belong to the first class, which is divided into two groups. In the first belong those substances in which a change in crystallization occurs without a corresponding change in homogeneity. In the second class belong those bodies which, when heated, break up into a large number of individuals of a different grade of symmetry from the original individual, without definite contours and without definite arrangement. To explain the first class the author supposes the molecules in the crystal particles to undergo a rearrangement coincident with that of the particles themselves. This is called direct polymorphism. Indirect polymorphism is the term applied to the change the second class of substances undergo. In these the symmetry of the particles changes, while that of the aggregate of particles remains unchanged. To the first class only is the term polymorphism strictly applicable. The second class belong rather to the paramorphic bodies. The second part of the paper contains results of observations on polymorphic substances, among which are the bichromates of rubidium, potassium, and ammonium, and the sulphates of sodium and of lithium.——O. Lehmann,[14] in a very brief communication, states his view of crystal structure, which is quite different from that of Wyrouboff. He declares that the essential condition of a crystal is not the regular arrangement of the molecules in the particles, but it is the construction of these molecules. He also reiterates the statement made in his "Molecular Physik" to the effect that no chemical substance can crystallize in more than one way. Allotriomorphic and polymorphic substances are different chemically. In a second paper[15] he gives brief descriptions of eight additional organic compounds that show allotropic forms.——The parts of Dr. Hintze's[16] Mineralogy continue to appear with commendable rapidity. The fourth part concludes the discussion of prehnite, takes up in order axinite, harstigite, and the pyrosmalite group, and begins the treatment of the micas, which occupies one-hundred-and-twenty-five pages, and is not yet finished. Although there are perhaps some omissions to be noted with respect to American occurrences, the thoroughness of the author's work cannot be gainsaid. The analyses of biotite given in the article on that mineral number 177, and those of muscovite 120, in addition to some twenty or thirty of varieties of these minerals.——Dufet[17] describes a new method for the determination of the optical orientation and of the dispersion of the axes in triclinic minerals, and applies his method to the study of potassium bichromate.——Mr. Lane[18] illustrates a method for determining the planes in crystals in thin section. It is based in the relations existing between the zone-circles and face-points in a stereographic projection.

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[5] *Neues Jahrb. f. Min.*, etc., 1891, I., p. 211.

[6] Jannetaz. Bull. Soc. Franc. d. Min., XIII., 1890, p. 372.

[7] *Neues Jahrb. f. Min.*, etc., 1891, I., p. 109.

[8] Bull. Soc. Franc. d. Min., XIII., 1890, p. 330.

[9] Osann. *Neues Jahrb. f. Min*, etc., 1891, I., p. 108.

[10] Bull. Soc. Franc. d. Min., XIII., 1890, p. 450.

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[11] *Neues Jahrb. f. Min.*, etc., B. B. VII., p. 434.

[12] Bull. Soc. Franc. d. Min., XIII., 1890, p. 277.

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[13] Cf. AMERICAN NATURALIST, Feb., 1890, p. 174.

[14] *Zeits. f. Kryst.*, XVIII., 1890, p. 456.

[15] Ib., p. 464.

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[16] Handbuch der Mineralogie. 4te Lief., pp. 481–640. Leipzig, 1891.

[17] Bull. Soc. Franc. d. Min., 1890, p. 341.

[18] Bull. Geol. Soc. Amer,, Vol. II., 1891, p. 365.

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MINERALOGY AND PETROGRAPHY.[1]

New Minerals.—*Aguilarite.*—A new regular mineral from Guanajuato, Mexico, has been named by Genth[2] *aguilarite.* It is imbedded in colorless calcite as brilliant iron-black skeleton dodecahedrons, elongated in the direction of one of the crystallographic or one of the octahedral axes. The mineral is sectile. It possesses no cleavage, has a hardness of 2.5 and density of 7.586. Its composition ($Ag = 79.07$; $S = 5.86$; $Se = 14.82$) corresponds to $Ag_2S + Ag_2Se$. Upon alteration it yields a scaly iron-black substance, with the composition of cupriferous stephanite, and metallic silver.——*Griphite.*—In the granite at the Riverton Lode, near Harney City, South Dakota, occur kidney-shaped masses of a phosphate, dark brown in reflected light, and yellowish-brown or brown in transmitted light. It is amorphous, and has no cleavage. Its density is 3.401, and its hardness 5.5. It is easily fusible in the flame of a candle, and is soluble in acids. Its composition, as found by Mr. Headdon,[3] is:

P_2O_5	MnO	CaO	Al_2O_3	FeO	MgO	Na_2O	K_2O	Li_2O	H_2O	Ċe	F	Ues
38.52	29.64	7.47	10.13	4.00	.15	5.52	.30	tr.	4.29	.11	tr.	.16

On account of its composition, which cannot be represented by a simple formula, the author calls the substance *griphite*, from γριφος, a puzzle.——*Kaliborite*[4] is associated with pinnoite and boracite in the upper layers of the Kainite zone at Stassfurt, Germany. It is a white, granular substance with a density of 2.05. It is slightly soluble in water, and dissolves easily in dilute acids. Its composition is:

$$\begin{matrix} B_2O_3 & MgO & K_2O & H_2O \\ 57.46 & 12.06 & 6.48 & 24.00 \end{matrix} = K_4Mg_9B_{48}O_{83} + 39H_2O.$$

——The new mineral *falkenhaynite*, described by Scharizer[5] from Joachimsthal, Bohemia, is regarded by Sandberger[6] as a member of the bournonite group, differing from annivite in containing more antimony and less arsenic than this latter, and almost no bismuth. Its composition, as found by Scharizer, is:

S	Sl	As	Bi	Cu	Fe	Qu
25.76	24.30	5.02	.34	39.77	2.83	1.99

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] *Amer. Jour. Sci.*, May, 1891, p. 401.

[3] *Amer. Jour. Sci.*, May, 1891, p, 415.

[4] Chemkier Zeits., 1889, p. 1188. Ref. *N. J. B. f. Min.*, etc., 1889, I., p. 237.

[5] Jahrb. I. K. K. Geol. Rich., 1890, p. 433.

[6] *Neues Jahrb. f. Min.*, etc., 1891, I., p. 274.

The mineral is steel-gray, with a grayish-black streak.——*Sanguinite*[7] is associated with argentite and proustite at Chañarcillo, Mexico, as bronze-red scales, containing sulphur, arsenic, and silver. By reflected light the scales are black; by transmitted light they are red. The streak is dark purplish-red. Crystallization probably hexagonal. The material available was too scanty to allow of analysis.——*Kallicite*, from Grube Friedrich, near Schöristein, on the river Sieg, in Prussia, is a nickel sulph-antimonide of composition, according to Laspeyres,[8] as follows:

S	Sl	As	Bi	Fe	Co	Nic
14.391	44.942	2.016	11.758	276	.889	26.943

equivalent to NiAsS+2NiBiS+13NiS6S. Its specific gravity is 7.011, and its position in the systematic classification of minerals is with ullmannite.——*Sychnodymite* is described by the same writer as a new cobalt-copper-sulphide from the Kohlenbach Mine, near Siegen, Prussia, corresponding to polydimite among the nickel compounds. The mineral occurs in little twinned octahedra of a darker color than those of polydimite. It is associated with quartz, tetrahedrite, and pyrite. Its density is 4.758, and composition:

S	Cu	Fe	Co	Ni	
40.645	18.984	.927	35.786	3.658	$=(CoCuNiFe)_4S_6$

Mineralogical News.—Honey-yellow or greenish-yellow crystals of *axinite* from Franklin, N. J., have an unusual tabular habit, with the P^1 face largely developed. They also contain several rare planes, well developed, and a new face, $\frac{3}{2}P^1_{\bar{3}}$. Their axial ratio is $a:b:c=$ 4921 : 1 : .4797, and $\alpha = 82° 54' 13''$, $\beta = 91° 51' 43''$, $\gamma = 131° 32' 19''$. Their specific gravity is 3.358, and composition:[9]

SiO_2	B_2O_3	Al_2O_3	Fe_2O_3	CuO	QuO	MnO	MgO	CaO	Ign
.76	42.77	5.10	16.73	.12	1.48	13.69	.23	18.25	.76.

Lamellar masses of the same mineral have a density of 3.306. Their composition does not vary much from that of the crystals. Crystals of the same mineral from Guadalcazar, Mexico, are associated with white feldspar. These are sage-colored. They are tabular parallel to ^1P, and their faces are frequently rounded. Granular scaly masses identical in character with the crystals yielded:

SiO_2	B_2O_3	Al_2O_3	Fe_2O_3	CuO	MnO	MgO	CaO	Ign
42.85	5.17	16.96	5.00	.19	9.59	.87	18.49	.75

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[7] Miers. *Mineralogical Magazine*, IX., p. 1.

[8] *Zeits. f. Kryst.*, XIX., 1891, p. 12.

[9] Genth, Penfield and Pirsson. *Amer. Jour. Sci.*, May, 1891, p. 394.

The density of the crystals is 3.200. A small fragment of the same mineral from McKay's Brook, Northumberland Co., N. S., was not large enough for analysis.——Massive rose-colored *eudialyte*[10] from Magnet Cove, Ark., has a specific gravity of 2.810. Analysis gave:

SiO_2	ZrO_2	Ta_2O_5?	FeO	MnO	MgO	CaO	Na_2O	K_2O	Cl	Ign.
51.83	11.45	.51	4.37	.37	.11	14.77	13.29	.43	1.42	1.88

——*Sphene* occurs at Magnet Cove, in small brown or brownish yellow crystals, associated with the constituents of elæolite-syenite. They are simple combinations of ∞P and −P.

SiO_2	TiO_2	FeO	MgO	CaO	Ign	Sp.Gr.
.57	30.84	39.35	.73	tr.	28.26	3.457

——At the same locality, in a coarse-grained calcite, are crystals and crystalline grains of *monticellite*, associated with crystals of magnetite and apatite. The habit of the rare mineral is short prismatic, with pyramidal terminations ∞P$\breve{\infty}$ and 2P$\breve{\infty}$ largely developed (axial ratio =.4337 : 1 : .5757). The hardness is 5; density, 3.108. The mineral, upon analysis, gave, as a mean of two sets of determinations:

SiO_2	Al_2O_3	MnO	FeO	MgO	CaO	P_2O_5	Ign
33.46	.17	1.12	5.01	20.61	35.24	2.03	2.28

deducting the P_2O_5 as apatite, which was present in the assay, the figures became:

SiO_2	Al_2O_3	MnO	FeO	MgO	CaO	Ign
35.14	.19	1.17	5.25	21.64	34.21	2.40

corresponding to $(Mg,Mn,Fe)_2SiO_4+Ca_2SiO_4$.——A light-gray seleniferous *bismuthinite*, consisting of slender crystals imbedded in clay, yielded Genth:[11] Bi = 77.54; S = 14.06; Se = 8.80, corresponding to $4Bi_2S_3+Bi_2Se_3$. It probably came from Guadalajara, Mex. Its density is 6.306. As the mineral was sent to the author as a specimen of *guanajualite*, an analysis of a specimen of this from an old German collection was made in order to discover whether or not it should be regarded as a distinct species. The examination resulted in the figures: Bi = 68.86; S = 4.68; Se = 25.50, corresponding to $Bi_2S_3+2Bi_2Se_3$. ——Messrs. Melville and Lindgren[12] have contributed to our knowledge of the minerals of the Pacific slope some interesting observations in *cinnabar*, *metacinnabarite*, *struneyerite*, and a few other rare substances, among which are the recently described minerals *knoxvi*[illegible] and *redingtonite.* Cinnabar from the New Idria Mine, California, ash a prismatic or rhombohedral habit, with the basal plane and a series of rhombohedra and tetarto-trapezohedrons well developed. The crystals are made up of layers of dextro- and lævo-rotatory material. At Knoxville acicular crystals occur with $-\frac{4}{5}R$, and ∞R. They encrust metacinnabarite that occurs in seams in a vesicular marcasite. An analysis gave: $HgS = 98.48$; $FeS = .69$; $SiO_2 = .71$. Analysis of redingtonite and knoxvillite yielded:

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[10] Cf J. F. Williams. *Amer. Jour. Sci.*, Dec., 1890.

[11] *Amer. Jour. Sci.*, May, 1891, p. 402.

[12] Bull. U. S. Geol. Survey, No. 61.

	SO_3	Al_2O_3	Cr_2O_3	Fe_2O_3	FeO	NiO	MnO	MgO	Res	H_2O at 100°
R.	35.35	5.14	7.51	.18	4.58	1.00	tr.	1.85	3.46	27.09
K.	35.91	4.84	7.41	15.36	3.81	.835		3.22	1.74	9.30

	H_2O above 100°
R.	14.34
K.	17.60

Copiapite in soft masses and sulphur-yellow scales and crystalline particles contains:

SO_3	Fe_2O_3	FeO	MnO	MgO	H_2O
39.97	26.54	.46	.21	3.06	30.43

Stromeyerite from the Silver King Mine, San Bernardino county, Cal., has a specific gravity of 6.28, a steel-gray color on a fresh fracture, and a composition: $Ag = 53.96$; $Cu = 28.58$; $Fe = .26$; $S = 15.51$; $Res = 1.55$. The rare chromium chlorite *Kotschubeite* is found in the serpentine at Green Valley, Cal., as thin, hexagonal plates arranged in rosettes. The plates are twinned monoclinic crystals, with an optical angle of about 30°, and an acute bisectrix nearly normal to oP. The type mineral from the Urals is in apparently hexagonal pyramids. The composition of the California mineral is:

SiO_2	Cr_2O_3	Al_2O_3	FeO	MiO	CaO	MgO
35.74	11.39	6.74	1.23	4.87	.183	35.18

Loss at 105°	Loss above 105°
.365	12.68

——In a note on some Canadian minerals Mr. Harrington[13] mentions the existence of *göthite* crystals, forming a velvety druse on hematite, calcite, and other minerals at Clifton, N. S. At the same place radiating needles of the iron compound are found capped with rhombohedra of calcite. One specimen yielded: $Fe_2O_3 = 88.92$; $Mn_2O_3 = .14$; $H_2O = 10.20$; $SiO_2 = .32$. A white to pale apple-green *serpentine* occurs as veins in a darker serpentine at an asbestos quarry near

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[13] *Can. Record of Science*, Vol. IV., No. 2, 1890.

Coleraine, in the Eastern Townships. When first mined it is so soft as to be easily squeezed between the fingers, but on exposure it becomes harder until a hardness of 3.5 or more is reached. It then has a density of 2.514, and a composition: $SiO_2 = 43.13$; $MgO = 42.05$; $FeO = .37$; $H_2O = 13.88$, with traces of MnO, NiO, and CaO. Cinnamon *garnet* from Ottawa county, Ont., has a density of 3.58, and a rose-red *almandine* from the Laurentian gneiss at Murray Bay, Que., has a specific gravity of 2.59. Small red *spessartites*,[14] imbedded in the feldspar and muscovite of a coarse granite vein at Villeneuve Mine, Ottawa county, are much heavier. Sp. gr. = 4.117. The composition of these is:

	SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	Loss
Cinnamon	36.22	18.23	7.17		.63	37.39	tr.	.70
Almandine	37.97	22.44	2.39	26.12	1.18	5.27	5.42	
Spessartite	36.30	19.20		10.66	30.06	3.07	.43	.31

From the dump heaps of the Grant and Emerald Mines, in Buckingham, in the same county, specimens of mountain cork and mountain leather were obtained that yielded:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	Loss	Sp. Gr.
53.99	.55	1.00	10.99	2.19	12.53	16.25	2.56	3.05

Since pseudomorphs of *asbestos* after pyroxene are found in the vicinity, it is thought that the material analyzed may be of the same nature. *Dawsonite* and *ittnerite* occur at the Corporation Quarry, on the west side of Montreal Mountain, and fine chalcedony concretions are imbedded in the clay between Irvine and the Cypress Hills, in the northwest territory.——The analyses of several minerals are given in a recent bulletin of the U. S. Geol. Survey,[15] among which the following are the most interesting: (1) *petalite*, from the spodumene locality at Peru, Me.; (2) *spessartite*, from the Mica Mine, Amelia county, Va.; (3) *willemmite*, Trotter Mine, Franklin, N. J.; (4) *kaolin*, from the Waterfall Mine, Gunnison county, Col.

	SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	ZnO	CaO	Na_2O	K_2O	Li_2O	P_2O_5	H_2O and Loss
(1)	77.29	16.95	tr.	tr.				2.39	tr.	2.62		1.03
(2)	35.35	20.41	2.75	1.75	38.70		.94					.27
(3)	27.41					68.86						.25
(4)	47.28	36.19	tr.				.42	.51	5.74		.57	8.72

Triplite, from a tin mine near Rapid City, S. Dak., gave:

Al_2O_3	Fe_2O_3	FeO	MnO	CaO	Na_2O	P_2O_5	H_2O	F	SiO_2	Cl	CO_2
8.74	2.36	1.97	29.13	6.72	5.25	39.68	3.67	2.35	.43	.25	.26

besides traces of MgO and K_2O, and .13 per cent. LiO_2.

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[14] *Can. Record of Science*, October, 1890, p. 225.

[15] Bull. No. 60, U. S. Geol. Survey, pp. 129–137.

From the AMERICAN NATURALIST, September, 1891.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—In an argumentative article on the individuality of rocks Lang[2] proposes to regard as a rock individual the product of a continuous (uninterrupted) rock-forming process. Accordingly he would class interbedded clays, sandstones, and conglomerates deposited from the same body of water by a gradual lessening of its velocity, as a single rock, with clayey, sandy, and conglomeratic facies. In the eruptive group, that is a rock individual which has been forced from the depths of the earth by a single earth-throe. The beginning and end of a rock-forming process thus marks the limitations of a rock individual, even though a second period of similar processes should subsequently give rise to a rock of the same nature as that previously formed. The ideas discussed in the article are of great interest, but the practical advantages to be gained by regarding rocks from the point of view of its author are not immediately perceptible.—— Another article of some theoretical interest is Justus Roth's criticism of Rosenbusch's[3] recent paper on the chemical nature of eruptive rocks. After giving a short historical review of the attempt to explain the variation in eruptive rocks upon a chemical basis, the author[4] proceeds to examine critically the views set forth by Rosenbusch. In the first place, he states that ten of the sixty-three rocks whose analyses are quoted by this writer are much altered from their original condition; others are but local in distribution, while of others, again, the analyses are incomplete. He further continues by showing that the fundamental magmas by whose mixture the various types of rocks are regarded as made up, far from giving rise to definite varieties when mingled in definite proportions, may themselves consist of different combinations of different minerals. He then calls attention to what appear to be weak points in Rosenbusch's calculations, and concludes with the statement that there is not yet sufficient knowledge concerning the chemical character of eruptives to warrant the construction of a theory concerning their composition.——Loewinson-Lessing[5] has attacked the chemistry of the eruptive rocks in a little different way from Rosenbusch. He compares the relations between the bases and the acid in a rock, and calls those rocks acid that contain an excess of the latter,—*i. e.*, more than enough to saturate the bases present. This excess shows itself as free quartz. Thus it is not the percentage of silica in a rock-mass that carries it into the acid, neutral or basic class, but it is the lack or excess of silica as compared with the bases. Several empirical formulas represent the author's types. They are based on the determined ratio between bases and acid in neutral rocks, in which the amount of silica necessary to saturate the bases (in percentage) is represented by formula $SiO_2 = 2(R_2O + RO) + R_2O_3$. In neutral rocks this relation exists, consequently the formula represents the composition of such rocks. The amount of silica in basic rocks is represented by $SiO_2 = R_2O + RO + R_2O_3$, and in acid rocks $SiO_2 = 2(R_2O + RO) + R_2O_3 + \text{Quartz}$,—*i. e.*, the percentage of silica in these is greater than twice the sum of the percentages of R_2O and RO, plus R_2O_3, by as much as there is quartz in the rock. The author then uses these formulas, with others deduced from them, as a basis for the classication of eruptives. His paper is interesting reading, and if facts justify his formulas the conclusions reached by the author will prove of value to petrographers.——Some recent discussions on the pressure alteration of basic eruptives have added quite a little to our information regarding this phenomenon. Welch[6] has described the alteration of diabases into schists in the region of the Soonwalde, in the Taunus, on the left side of the Rhine. Well-developed diabases exist near Rauenthal. Under the influence of pressure they have given rise to schistose rocks containing actinolite, and others in which chlorite and epodite have replaced the original augite. Other schists, whose relationship to diabase can be determined only by a microscopical examination, have been called hornblende-sericite-schists, augite-schists, and sericite-calc-phyllites. The author has made a careful study of all these, which has resulted in their separation into schists composed of actinolite and epidote, those containing a blue amphibole, and finally those made up principally of chlorite. In some of these derived rocks augite may still be detected, in others the diabase structure is still visible, while in a third class no traces of the original constituents nor of their arrangement are recognizable. All show evidence of pressure in the shapes of their components and in their nature. In the first class the epidote and chlorite have been derived from augite. The second class contains, in addition to glaucophane, a bluish-green actinolite, sericite, and biotite. Epidote is entirely wanting. The rocks of the third group are combinations of chlorite, quartz, sericite, and generally calcite. In each the structure is schistose, and the mother-rock was a diabase or a diabase-porphyrite. The paper concludes with a discussion of fifteen analyses of the rocks described.——Dynamically altered diabase and gabbros (sometimes schistose) occur also as sheets and dykes cutting altered sediments at St. Johnstown and Raphoe, in N. W. Ireland. Among them are epidiorites in which, according to Hyland,[7] the hornblende still preserves the ophitic structure of the original augite. The original feldspar was labradorite, but the changes effected in it have yielded a quartz-feldspar-epidote mosaic in which the secondary feldspar is oligoclase.——The schists, granulites, and even some of the massive rocks of the Lizard, England, are distinctly banded. To account for the phenomenon it has been suggested that it is due either to original sedimentation, or to the deformation of eruptive rock-masses, or to the injection of rock material along planes of weakness in preëxisting rocks. Since the schists are now known to be eruptive, the first explanation is not available. Against the second Somervail[8] brings the following objections, viz.: the symmetry of the banded structure, the frequent transitions between adjacent bands, and the uniform banding in large masses of the same composition. The injection theory is contradicted by the absence of irruptive contacts. He accounts for it on the supposition that segregations formed during the cooling of the magmas, yielding "schieren" that were afterwards squeezed.——A green schistose rock from near Zermatt, in the Pennine Alps, occurs so associated with other schists that Bonney[9] is compelled to regard it as a pressure schist derived from serpentine. The rock is so very fissile that it may be split into sheets one-eighth of an inch thick. Only two essential constituents are observed in it, one an olive-green mineral, occurring in small translucent flakes with a cleavage like mica and an extinction parallel to this, and the other a chromite or magnetite. The former mineral may possibly be antigonite. Associated with this rock are two other schists: one, a green schist, is a soft chloritic rock, composed of chlorite, magnetite, and zoisite (?). The composition of the chlorite is probably near that of chloritoid. The other schist is full of talc. The origin of neither of these could be determined.——A suggestion in explanation of the cause of the transitions sometimes seen between crystalline and clastic rocks has recently been offered by Prof. Pumpelly,[10] who believes that rock disintegration by weathering

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.

[2] *Miner u. Petrog. Mitth.*, XI., p. 467.

[3] AMERICAN NATURALIST, 1890, p. 1071.

[4] *Zeits. d. deuts. geol. Ges.*, 1891, p. 1.

[5] Bull. Soc. Belge de Géol., etc., IV., 1890, p. 1.

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[6] *Zeits. d. deuts. geol. Ges.*, XLI., 1890, p. 394.

[7] *Geol. Magazine*, 1890, p. 205.

[8] Ib., Nov., 1890, p. 509.

[9] Ib., Dec., 1890, p. 533.

[10] Bull. Geol. Soc. Amer., Vol. II., p. 209.

has, in many cases, given rise to thick accumulations of loose material, which has subsequently been used in the manufacture of the detrital beds. If the new beds were laid down under the influence of gentle currents their basal member would contain a large proportion of the material of the older rocks, and would thus simulate them to a greater or less extent. If this explanation is found to hold good, it will obviate the supposed necessity of regarding granite and gneiss as derived from fragmental rocks by some form of obscure metamorphism.——Rosenbusch[11] attacks the subject of the origin of the schists from a chemical standpoint. He shows by citing analyses that some foliated rocks have compositions corresponding to those of massive rocks. These he regards as squeezed eruptives. Others are different in composition from any known eruptive. These he regards as dynamically changed sedimentaries. The foundation principle underlying the argument is that dynamo-metamorphism affects but little chemical change in the material upon which it acts, except such as may be brought about by percolating water.

Mineralogical News.—The unique mineral *melanophlogite* has been made the subject of recent study by Friedel[12] and by Streng.[13] The former writer has examined the apparent cubes of the mineral in polarized light, and has found them to consist of six tetragonal pyramids, with their apices turned in and their bases forming the sides of the cubes. When heated the substance blackens and finally becomes opaque. Its density is 2.030–2.052, and the angle between contiguous cubic faces 91° 23′. The cubical cleavage reported by Lacroix does not exist. Some crystals appear to be simple cubes, while others are made up of many individuals, which in their section appear as fibers radiating from a center. They owe their form, consequently, not to pseudomorphism. They are pseudo-regular. A very careful analysis of these crystals yielded a result corresponding to $20SiO_2+SO_3$, with small quantities of $SrSO_4$ and carbon. The crystals are implanted in opal. Other crystals, very similar to those described above, are the pseudomorphs of quartz described by Mallard. They have not the same density as melanophlogite, nor the same optical properties. The formation of the latter mineral is ascribed to the action of SO_3 on quartz. The author also describes fibrous crystals formed by the grouping of hexagonal lamellæ with most of the properties of the tetragonal melanophlogite. Analysis of these gave $SiO_2 = 93.2$ per cent., $SO_3 = 5.7$ per cent. This substance loses twelve per cent. of its weigh ton heating, while the tetragonal mineral loses six per cent. Streng declares that the mineral does not contain sulphuric acid, since it yields SO_3 only when treated with an oxidizing agent. Whether the sulphur is in the form of free sulphur or of an organic sulphide, could not be determined by him. The crystals, according to this author, are bounded by $\infty O \infty$ and $\infty O 2$, and are probably pseudomorphs of opal and quartz after some unknown mineral.——A little more than a year ago the nodular rose-red *eudialite* of Magnet Cove, Arkansas, was described by Hidden and Mackintosh.[14] Recently crystals of the substance have been investigated by Dr. J. F. Williams.[15] These are tabular transparent or translucent rose-colored or crimson bodies traversed by cracks in all directions. They are hexagonal with $a : c = 1 : 2.1174$. OR, $\infty P2$, R, $-\frac{1}{2}R$, $-2R$ appear on one crystal, and on another occur in addition $-\frac{8}{11}R$, $\frac{1}{4}R$. $\frac{1}{8}R$ and $-\frac{3}{4}R^5$. The density varies between 2.804 and 2.833, and the double refraction is positive. It is one of the youngest of the constituents of the eleolite-syenite in which it occurs. The negatively refracting *eucolite*, of about the same composition as eudialite, appears in brownish-yellow crystals in the same rock. In it a cleavage parallel to OR is quite pronounced. OR, R, $-\frac{1}{2}R$, ∞R, and $\infty P2$ bound its crystals. Its specific gravity is 2.6244–2.6630, and its hardness 5–5.5. He thinks it may be an altered eudialite.——The zinc-bearing *rhodonite* from Franklin and Sterling, N. J., has been reinvestigated by Pirsson.[16] The crystals are usually tabular and elongated, parallel to $\infty{,}\acute{P}$. The new planes $2P\overline{\infty}$, $4P\overline{\infty}$ and $4P'$ were observed. The axial ratios, calculated from the best measurements obtained, are: $a : b : c = 1.078 : 1 : .6263$, $\alpha = 103° 39'$, $\beta = 108° 48' 30''$, $\gamma = 81° 55'$. The cleavage is prismatic, and the extinction on the basal plane is 54° from the edge $OP \wedge \acute{P}{,}$. Since the crystallographic constants and the extinction of the mineral differ so slightly from those of rhodonite, it seems that the morphotropic action of the zinc is but slight. Composition :

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[11] *Miner. u. Petrog. Mitth.*, XII., p. 49.

[12] Bull. Soc. Franc. d. Min., XIII., 1890, p. 356.

[13] Ber. d. Oberhess. Ges. f. Naturw. und Heilk, 1890, p. 114. Ref. *Neues Jahrb. f. Min.*, etc., 1891, I., p. 18.

SiO_2	FeO	ZnO	MnO	CaO	MgO
46.06	3.63	7.33	34.28	7.04	1.30

corresponding to $RSiO_3$.——Upon data collected during the course of many analyses of *uraninite* from American and foreign localities, Mr.

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[14] *Amer. Jour. Sci.*, XXXVIII., 1889, p. 494.

[15] Ib., Dec., 1890, p. 457.

[16] Ib., XL., Dec., 1890, p. 484.

Hillebrand[17] concludes that nitrogen is a constant constituent of the mineral, and in a form different from any hitherto observed in the mineral kingdom; that its composition varies widely, and with it the physical characteristics; and, finally, that the composition does not correspond with any formula proposed to represent it. The author proposes to continue its study, and asks the aid of mineralogists in securing specimens.——Excellent transparent crystals of *anthophyllite* have been obtained by Mr. Penfield[18] from Franklin, Macon county, N. C. They are prismatic with P and $\infty P\breve{}$, but no terminations. The ratio $a : b$, based in approximate measurements, is .51375 : 1. The cleavage is perfect parallel to the prism and the brachypinacoid, and poor parallel to the macropinacoid, $2V_a = 88° 46'$, with the corresponding index of refraction for $\beta = 1.6353$; $a = A$, $b = B$, $c = C$. The double refraction is negative for green and yellow light, and positive for red light. Density = 3.093. The composition is:

SiO_2	FeO	MnO	MgO	CaO	H_2O	Al_2O_3	Loss at 100°
57.98	10.39	.31	28.69	.20	1.67	63	.12

——The so-called *perowskite*[19] from Magnet Cove, Ark., proves upon analysis to contain niobium and tantalum, and, therefore, to belong with dysanalyte, and not with perowskite. Its density is 4.18, and composition:

CaO	MgO	FeO	Fe_2O_3	$(Y.Er.Ta)_2O_3$	$(CeLaDi)_2O_3$	Nb_2O_5	Ta_2O_5	TiO_2	SiO_2
33.22	.74	.23	6.16	5.42	.10	4.38	5.08	44.12	.08

——Some new facts with reference to the *beryls*, *bertrandites*, and *phenacites* from Mt. Antero, Col., are communicated by Penfield.[20] The crystals occur implanted in granite or on the feldspar and quartz of this rock. The beryl probably afforded the beryllium for the other two minerals. It occurs in light-green or blue prismatic crystals, usually simple combinations of P and OP, but occasionally also with 2P2 and $\infty P\frac{3}{2}$ The peculiarity of the crystals is the number of depressions observed on various planes. These are pits bounded by pyramidal faces, and into them long needles of beryl project. The forms on the needles are $12P\frac{6}{5}$, 12P2 and 2P. The axial ratio of the *bertrandite* is .5993, instead of .5953, as printed in the author's first paper[21] on the mineral. Some of the crystals of phenacite are interpenetration twins, with the base the twinning plane.——*Harmotome* is announced by Ferrier[22] as occurring in calcite filling vuggs in veins cutting the Animikie slates in the vicinity of Rabbit Mountain, Ontario. Besides calcite, the minerals associated with the harmotome are amethyst, fluorite, and pyrite.——Black tin-bearing *rutile* crystals, supposed to be from the Harney Peak district, in the Black Hills, have a density of 5.294. Its composition, according to Headdn eand Pirsson,[23] is $TiO_2 = 90.79$; $FeO = 8.01$; $SnO_2 = 1.35$. The habit is orthorhombic, with P∞, ∞P∞ and P, twinned parallel to 11P∞.——Tin ore has not yet been found in workable deposits in Texas. Most of the material from that state reported as being cassiterite is keilhanite,[24] tourmaline, or black garnet.——Analyses of rhodochrosite from Franklin Furnace, N. J., yielded Browning,[25] after correcting for impurities, the following figures:

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[17] Ib., Nov., 1890, p. 384

[18] Ib., Nov., 1890, p. 394.

[19] Ib., Nov., 1890, p. 403.

[20] Ib., 1890, p. 488.

[21] Ib., XXXVI., 1888, p. 52.

MnO	CaO	ZnO	MgO	FeO	Fe_2O_3	CO_2	Sp. Gr.
45.55	11.41	1.48	1.78	.22	.16	39.40	3.47

Miscellaneous.—It is a pleasure to know that Messrs. Clarke and Schneider[26] are busy with experiments looking toward the settlement of problems relating to the constitution of natural silicates. The methods employed by them resemble somewhat those that have afforded such excellent results in organic chemistry. Silicates are exposed to the action of hydrochloric acid gas at high temperatures, and to its solution at ordinary temperatures, and the effects in each case are noted. They are then ignited and subjected to other reagents, and the products here obtained are compared with the results of the former experiments. In this way the presence of groups of elements is recognized that are analogous to the residues of carbon chemistry. The conclusion already arrived at by the authors are to the effect of *talc* is an acid metasilicate ($Mg_3H_2(SiO_3)_4$), and not a basic salt of pyrosilicic acid ($Mg(Si_2O_5)_2(MgOH)_2$) as Groth suggests. *Serpentine* is thought be a substituted orthosilicate corresponding to $Mg_2(SiO_4)_2H_3(MgOH)$, and its relation to olivine and chondrodite are represented as follows: Olivine $= Mg_4(SiO_4)_2$; chondrodite $= Mg_3(MgF)(SiO_4)_2$; serpentine $= Mg_2(MgOH)H_3(SiO_4)_2$. *Chlorite* is regarded as $R''_2(SiO_4)_2R'_4$, or olivine with half the magnesiem replaced by R′, and the fluoriferous

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[22] Ib., Feb., 1891, p. 161.

[23] Ib., March, 1891, p. 249.

[24] Ib., March, 1891, p. 251.

[25] Ib., Nov., 1890, p. 375.

[26] Ib., 1890, XL., p. 312, 405.

phlogopite from Burgess, Ont., as $Al(SiO_4)_3Mg_3KH_2+Al_2(SiO_4)_3Mg_2K(MgF)$.——Beĺowsky[27] finds that green hornblende, when subjected for some time to the heat of a bunsen burner, changes its color, the character of its pleochroism, the strength of its double refraction, and the position of its planes of extinction, and becomes in all respects similar to the basaltic variety. Upon the addition of a little sodium chloride[28] to a solution of sodium sulphate, the latter salt crystallizes upon evaporation as *thenardite*, and not as mirabilite. A mixture of potassium and sodium sulphate under the same conditions yield *glaserite*.——A few illustrations of regular growth of pyrite crystals are given by Smolar.[29] Some of the crystals (all of which are from Piedmont and Elba) are probably interpenetration twins according to some new law, while others are regular growth only. The author believes that our knowledge of twinned crystals is still in its infancy, and advises many more observations on regular intergrowths before we conclude as to the conditions of twinning. Rhombic pyramids of sulphur[30] crystallize from picoline or pyridine saturated with sulphuretted hydrogen.——The *oölitic iron ores* of the Cliniton group in the Alleghenies are not cemented concretions, as was supposed, but they are pseudomorphs of bryozoons, or of fragments of these.[31]

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[27] *Neues Jahrb. f. Min.*, etc., 1891, I., p. 291.

[28] Retgers. Ib., 1891, I., p. 276.

[29] *Zeits. f. Kryst.*, XVIII., 1890, p. 475.

[30] Ahrens. *Ber. d. deutsch. chem. Ges.* XXIII., 1890, p. 2708.

[31] *Amer. Journ. Sci.*, Jan., 1891, p. 28.

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MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The gabbros of the United States, which, until a few years since, were scarcely known, have recently been studied in typical regions. Prof. Chester[2] has lately communicated the results of his study of the great belt of these rocks crossing the northern part of Delaware and running southwesterly until it unites with that investigated by Williams in the Baltimore area. The rocks of the Delaware region differ from those of the Maryland area in that the former very frequently contain quartz. The normal rock is a hypersthene-gabbro, containing brown hornblende and biotite. This graduates into a more acidic phase by an increase in quartz, and at the same time an equally noticeable gain in biotite, until it becomes more properly a pyroxene-granite than a gabbro. On the other hand, by the increase of brown hornblende, regarded as original, and the assumption of a schistose structure, the normal gabbro grades into a gabbro-diorite or a hornblende-gneiss. Further, uralitization of the pyroxene gives rise to green schistose rocks, identical in nearly all of their characteristics with the gabbro-diorites of the Baltimore region. The author describes in detail each type found by him, and gives analyses of the feldspars of many of them. The plagioclase of the typical diallage-hypersthene gabbros is Ab_1An_2, while that of the more acid biotitic rock is Ab_2An. Gabbro-diorite is the name given to the schistose rock in which brown hornblende predominates over pyroxene. Since the hornblende is regarded as original, there would seem to be no sufficient reason for not calling the rock a diorite-schist, thus reserving gabbro-diorite for those schistose phases of gabbro in which the hornblende is largely secondary. By the loss of nearly all of their pyroxene the gabbro-diorites of both classes pass into hornblende-gneisses. In the gabbro-granites, derived from the gabbros by an increase in quartz and biotite, there are evidences of pressure action in the shattered condition of the quartz and feldspar. Norites, described by the author, are aggregates of quartz and feldspar, in which are imbedded phenocsyts of hypersthene. ——Messrs. Campbell and Brown[3] add two new varieties to the Triassic traps of Virginia, differing from those described from more northern localities in that they contain hypersthene. One is a hypersthene-diabase, and the other an olivine-hypersthene-diabase. The latter has been found only in one place,—viz., two miles north of Rapidan Station on the Virginia Midland R. R. The hypersthene-diabase occurs not only in various places in Virginia, but it has also been found north. It is slightly ophitic, inclining somewhat to the porphyritic. Its feldspar is a basic labradorite of the formula Ab_2An_6. The pyroxenes are a slightly pleochroic, polysynthetically twinned diallage, and a strongly pleochroic hypersthene. The former contains numerous microlitic inclusions, while the latter is free from them. Quartz, apatite, and green hornblende are accessories. In the olivine rock the olivine is largely idiomorphic, and is in large grains. The other constituents are the same as those of the hypersthene-diabase. The paper contains an excellent series of analyses of the rocks and their most important components.——Barrois[4] has given us a masterly discussion of the diabases and diabase-porphyrites of Silurian age, occurring as dykes and flows in Menez-Hom, Finistère, France. The diabases he divides according to structure into granular and ophitic types. Among the former are olivine-bearing varieties, sometimes containing hypersthene, and olivine-free kinds, containing orthoclase, quartz, and occasionally porphyritic augite. The porphyrites are divided into andesitic varieties in which the feldspar-microlites are older than the augite, and into variolitic kinds with feldspar younger than augite. A large part of the rocks of the region studied occur in the form of tuffs, in which the cementing material is shale, limestone, or sandstone, and the fragments are sometimes large enough to be called bombs. Schalstein is also common. The contact effects noticed in the eruptives are insignificant in amount. The schists in contact with the bedded diabases are spilosites, containing nodules of chlorite. The most interesting contact effects are those noticed in the case of nodules originally consisting of pyroxene and quartz. Under the influence of sea-water made hot by submarine ejections, these nodules have become zonal, in which the two zones differ principally in the size of their constituents, as both contain pyrite, albite, quartz, sphene, and limonite. In conclusion, the author makes some general remarks on the study of ancient volcanoes, and gives quite a good résumé of the work done in this direction.——A dyke of basic rock on Stop Island, in Rainy Lake, Canada, consists of diabase-porphyrite with an almost aphanitic texture on its contact. It contains occasional rounded masses of augite. Four feet from the contact it is a diabase, with the ophitic texture, and at fifteen feet from the contact it is also a diabase. Here, however, a portion of the augite is in idiomorphic crystals and in polysomatic grains, while another portion is in allotriomorphic masses between the feldspars. In the middle of the dyke the texture is gabbroitic, while hornblende replaces the augite. Quartz is also a prominent constituent of the center of the dyke, whereas it is only sparingly present at fifteen feet from the contact, and is entirely absent at the contact. Dr. Lawson[5] calls attention to these facts, and states that in the single geological unit represented by the mass of the dyke we must distinguish between three distinct rock types if we make use of present methods of nomenclature. He further thinks that the phenomena indicate that rate of cooling, rather than pressure, is the principal cause determining the textural condition assured by a solidifying magma. Other dykes exhibiting similiar pecularities are described from other localities in the Rainy Lake region. All show larger percentages of SiO_2 in their middle portions than are shown near their contacts,—a fact ascribed to the separation of basic augite, magnetite, etc., in those portions that cooled rapidly.——The larger part of the area of the Dippauer Gebirge in Northwestern Bohemia is covered by basalts, occurring in flows, dykes, and bosses, with their tufas and conglomerates. These are cut by phonolites and andesites, in the former of which are large grains of perofskite, in some cases showing parallel striations in parallel light. The basalts occur in all varieties, according to Clements.[6] The central portions of the hills are composed principally of leucite and nepheline basalts and the closely related rocks, nephelinites, leucitites, nepheline and leucite tephrites, and leucite-basanites. On the peripheries of the mountains are feldspathic basalts, limburgites, and augites. Among the most interesting features of the several rocks noticed are corroded biotite plates, surrounded by rims formed of secondary crystals of the same mineral, in the nepheline basalts; pseudomorphs of phillipsite after olivine in the leucitites; augite crystals with secondary twinning lamellæ produced by pressure in the nephelinites and feldspathic basalts; zonal augites in the leucitites, with an extinction varying gradually from the center to the periphery, and others with the hour-glass structure and an outer zone containing colorless microlites with their long axes lying parallel to the bounding walls of the crystals; and sanidine inclusions surrounded by augite crystals in leucite basalt. Leucite is more abundant in close proximity to an orthoclase inclusion in the last-mentioned rock than elsewhere in the rock-mass. Of the feldspathic basalts it was found that the youngest is most acid.——

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. U. S. Geol. Sur., No. 59.

[3] Bull. Geol. Soc. Amer., Vol. II., p. 339.

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[4] Bull. Serv. Carte Geol. d. Fr., No. 7, 1890.

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[5] *Amer. Geol.*, VII., 1891, p. 153.

[6] Jahrb. d. Kais-Kön. geol. Reichsanst, 1890, XL., p. 317.

Dr. Wolff[7] calls attention to the existence of ottrelite and ilmenite schists among the Paleozoic crystalline rocks of the Taconic region in the Green Mountains and in Massachusetts and Rhode Island. The Rhode Island rocks comprise micaceous schists and graywackes. In the former are grains of quartz, scales of muscovite, and occasional small patches of chlorite and bands of a mixture of graphite and ilmenite. Ottrelite crystals are scattered indiscriminately among the other constituents. In the graywacke the ottrelite occurs in irregular plates, which are free from optical deformities, while the other components of the rock give evidence of having been subjected to intense pressure. Even the mica, which owes its presence to metamorphic agencies, is bent and twisted. The absence of optical deformities in the ottrelite points to a very late origin for this mineral. The author also briefly describes a graphite-schist with ilmenite plates from Rhode Island. All the Rhode Island rocks are known only in boulders.——Singaelia[8] describes specimens of glassy lava from Vesuvius in the cabinet of the University of Berlin. Those from the streams of 1753 and 1809 consist largely of glass in which are tiny perfectly formed crystals of leucite and olivine and good crystals of augite and plagioclase. Other leucites are skeleton crystals, with their edges sharply defined, but their faces hollow. Two other specimens contain glassy portions between crystalline portions. Of these, one from the flow of 1822 contains hornblende, and another, whose age is unknown, has its anorthite and other crystals surrounded by rims of little rutile needles.——The ophiolites of Essex Co., N. Y., and the serpentines from Aqueduct Shaft No. 26, New York city, and from near Easton, Pa., have resulted by metasomatic changes from pyroxene, according to Merrill.[9] In the first-named rock the larger part of the serpentine, which is light green in color, is from a colorless pyroxene. Small particles of a darker-colored serpentine are scattered through the rock, and in these are enclosed graphite scales. Thin sections of these portions show them to consist of calcite, dolomite and serpentine. Originally they were probably composed of the first two minerals only. The serpentine is a subsequent formation, but by what method it was produced the author has not succeeded in determining.——A remarkable example of a Huronian volcanic tufa, from the nickel region at Sudbury, Canada, is reported by G. H. Williams[10] as composed of a glass breccia

[7] Bull. Mus. Comp. Zool., XVI., No. 8, p. 159.

[8] *Neues Jahrb. f. Min.*, etc., B.B. VII., p. 417.

Proc. U. S. Nat. Mus., XII., p. 595 ; Washington, 1890.

Bull. Geol. Soc. Amer., Vol. II., p. 138.

with its original flowage structure and the shapes of its included fragments well preserved through silicification. Calcite, glassy feldspar, and chlorite are the only minerals, with the exception of quartz and chalcedony, that can still be detected in the rock.——In a report on the iron ores of Minnesota,[11] by Messrs. N. H. and H. V. Winchell, Dr. Hensoldt describes a few of the rocks associated with the ores. Among them are various green schists, jaspers, chalcedony, etc.

Mineralogical News.—*American Minerals.*—Within the last few months a large number of articles have appeared containing the results of investigations of American minerals. Prof. Genth[12] reports some analyses of interesting minerals from the United States and Mexico. Bladed crystalline masses of *tetradymite* from Bradshaw City, Yavapai Co., Ariz., consist apparently of orthorhormbic plates, whose composition corresponds to $Bi_2(S_{1/3}Fe_{2/3})$ [Bi = 62.23 ; S = 4.50 ; Fe = 33.25]; so that in all probability the mineral belongs in the stibnite group. *Ziron* from Mars Hill, Madison Co., N.C., yielded him : SiO_2 = 31.83 ZrO_2 = 63.42 ; Fe_2O_3 = 3.23 ; Loss = 1.20. Its specific gravity is 4.507. Small crystals of *scapolite* associated with garnet at Elizabeth Mine, French Creek, Pa., gave :

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	CO_2	Loss	Sp. Gr.
52.30	23.68	.58	.05	12.36	6.29	.77	2.63	1.50	2.675

Both minerals appear to be alteration products of essonite. The garnet is brownish-gray or ash-gray in color. Its composition is given opposite (I.). A titaniferous variety, from the Jones Mine, Henderson Co., N. C., has a composition as opposite (II.) :

	SiO_2	Al_2O_3	Fe_2O_3	FeO	Mgo	CaO	MnO	TiO_2	CO_2	Loss	Dens.
(I.)	41.42	18.09	10.81		.59	26.19	.88		1.71	.51	3.390
(II.)	35.56	4.43	20.51	1.88	.17	31.90		4.58		.55	3.738

Analysis of *pyrite* from French Creek, Pa., and of *allanite*, are also given in the same paper. The green substance associated with the gold at Los Cerillos, N. M., supposed to be turquoise, was found in one instance to be *chromiferous clay*, and in another to be *cupriferous quartz*. Pseudomorphs of the latter mineral after stibnite are mentioned by the author as occurring at Durango, Mexico. In another article Prof. Genth[13] gives the result of an examination of *lettsumite* from the Copper Mountain Mine, near Morenci, Arizona, and from the American Eagle Mine, Copperopolis, Utah. In the first-mentioned locality, the substance forms incrustations of small, blue, fibrous tufts in a quartz gangue. Upon alteration it gives rise to a greenish-yellow, and finally to a fibrous yellowish-white material, often associated with hydrous aluminium sulphate. The Copperopolis specimens are velvety coatings of azure-blue silky fibers on a mixture of clay and lettsumite. The analyses of the two varieties, which are almost identical in composition, lead to the formula $Cu_4Al_2(OH)_{12}SO_4+2H_2O$.

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[11] Bull. No. 6, Nat. Hist. and Geol. Survey of Minn., p. 429.

[12] *Amer. Jour. Sci.*, August, 1890, p. 114.

[13] Ib., p. 118.

SO_3	CuO	Al_2O_3	Fe_2O_3	H_2O	Ins.	Sp. Gr.
12.49	46.71	16.47	1.34	21.89	.44	2.737

——Crystallized *metacinnabarite* (which has heretofore been found only in amorphous masses) has recently been discovered in the New Almaden Mine, California.[14] The crystals are implanted on quartz containing cinnabar crystals, which in turn occurs incrusting a selvage of clayey material forming an ore seam, whose origin is referred to solfataric action on the country rock. Spheres of a black organic substance are imbedded in the metacinnabarite, whose density is 7.118. Its composition follows:

S	Hg	Fe	Co	Zn	Mn	$CaCO_3$	Quartz	Org. Matter
13.68	78.01	.61	tr.	.90	.15	.71	4.57	.63

The crystals are rhombohedral and hemimorphic, with an acute pyramidal habit, and an axial ratio $a : c = 1 : .2372$.——In rotted galena on a contact between limestone and mica-schist at Mountain View Lead Mine, near Union Bridge, Md., Williams[15] has found small but good crystals of *anglesite* and *cerussite*, and a single crystal of *sulphur*, all of which are products of the decomposition of the lead ore. The three principal types of the anglesite are prismatic, parallel to the brachy-axis, with $P\breve{\infty}$ and $P\breve{2}$ predodominating, cuboidal, with $P\breve{\infty}$ and $\infty P\bar{\infty}$ the principal forms, and prismatic in the direction of the macro-axis, with $\frac{1}{4}P\bar{\infty}$ determining the habit. The cerussite presents a great variety of habits. One elbow twin is peculiar in that each of the two individuals is bounded on the inner side by $\infty P\breve{\infty}$, while the outer side contains in addition the brachy-domes $\frac{1}{2}P\breve{\infty}$, $P\breve{\infty}$, and $2P\breve{\infty}$. The sulphur crystal is very small, but it contains thirteen forms, of which eight are in the zone of the ground-pyramid and one $\frac{3}{8}P$ is new. ——The *polycrase* reported by Messrs. Hidden and Mackintosh[16] as occurring four miles from Marietta, S. C., and in Henderson Co., N. C. has been examined by these gentlemen, who find it forming tabular crystals with $\infty P\bar{\infty}$ largely developed, and the new forms oP, $\frac{1}{2}P\bar{\infty}$, and $\breve{P}\frac{3}{2}$ occurring on it. Several of the crystals are apparently twins, and those from South Carolina, when doubly terminated, appear to be both hemihedral and hemimorphic. The material for analysis was obtained by washing kaolinized coarse granite. This, when corrected for impurities, yielded:

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[14] Melville. Ib., Oct., 1890, p. 291.

[15] Johns Hopkins Univ. Circ., No. 87.

[16] *Amer. Jour. Sci.*, June, 1890, p. 302.

	Cb_2O_5	TiO_2	Y_2O_3 (etc.)	FeO	UO_3	PbO	Fe_2O_3	CaO	H_2O	Ins.	SiO_2
N.C.	19.48	29.31	27.55	2.87	13.77				5.18		
S.C.	19.37	28.51	21.23	2.47	19.47	.46	.18	.68	4.46	.12	1.01

Prof. Rowland, to whom the South Carolina specimens were submitted for microscopic study, found in them large amounts of scandium.——The same investigators[17] have examined lemon-yellow *auerlite* from Price's Land, Henderson Co., N. C., and a few other rare minerals. The auerlite has a density of 4.051–4.075, and a composition: $P_2O_5 = 8.58$; $SiO_2 = 6.84$; $ThO_2 = 72.16$ (diff.); $Fe_2O_3 = 1.78$; $H_2O = 10.64$. *Sulphohalite* they find to be probably tetrahedrally hemihedral. The *fayalite*[18] of Cheyenne Mt., Colorado, occurs sometimes in the granite in masses weighing as much as ten pounds. Analysis: $SiO_2 = 27.66$; $FeO = 65.79$; $MnO = 4.17$; $CaO = .47$. Mr. Hidden[19] also announces the discovery of *bastnaesite* and *tysonite*, near Manitou, Colorado, in a mass weighing over six kilograms, and gives four new localities for the occurrence of *fergusonite*, as follows: Associated with allanite, at Amelia Court House, Virginia; accompanying zircon, in the mines at Storeville, Anderson Co., South Carolina; at the Grassy Creek Mica Mine, in Mitchell Co., N. C.; and in the gold placers near Golden, Rutherford Co., N. C. The *orangite* of Landbö, Norway, is declared to be *uranothorite*. Its density is 4.322. A partial analysis gave 11.97 per cent. H_2O; 18.50 per cent. SiO_2; 52.53 per cent. ThO_2; 9 per cent. UO_3, and small quantities of other substances.——Associated with beryl and spodumene in the granite of the Nickel Plate tin claim, in Pennington Co., South Dakota, are nodules of a phosphate near *triphyllite* in composition. It is dark green in mass, and light yellowish-green in thin splinters. Its hardness is 5, and density 3.612. Analysis[20] yielded:

P_2O_5	FeO	MnO	CaO	MgO	Na_2O	K_2O	Li_2O	F	Ign.	Gangue
38.64	25.05	15.54	5.53	1.50	7.46	2.00	.28	.69	.73	2.47

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[17] Ib., May, 1891, p. 438.

[18] Cf. *Amer. Jour. Sci.*, March, 1885, p. 25.

[19] Ib., p. 439.

[20] Headdon. *Amer. Jour. Sci.*, May, 1891, p. 416.

——Penfield[21] has analyzed an *aurichalcite*, occurring in narrow seams in an impure limonite from Utah, which yielded an average:

CO_2	CuO	ZnO	H_2O	CaO	Dens.
16.36	19.37	53.09	9.92	.61	3.57 = $2RCO_3 3R(OH)_2$,

in which R = Zn and Cu, with CuO:Zno = 2:5.——Inexhaustible beds of *beauxite* have been discovered near Little Rock, Arkansas, and near Benton in the same state. According to Branner[22] they are genetically related in some unknown way with eruptive granites. The material is pisolitic in structure. A partial analysis of one specimen gave: $Al_2O_3 = 55.64$; $SiO_2 = 10.38$: $Fe_2O_3 = 1.95$; $TiO_2 = 3.50$; Loss = 27.62.——An analysis of *halotrichite* from Pitkin Co., Colorado, is given by Bailey[23] as follows:

SO_3	Al_2O_3	Fe_2O_3	FeO	MgO	H_2O at 100°	H_2O at over 100°
33.46	12.98	1.60	5.18	.17	33.10	12.94

——Farrington[24] has carefully examined the Arizona *azurites*, on which he finds the new forms $\frac{2}{3}P$, $\frac{4}{7}P$, $3P\frac{3}{2}$ and $\frac{12}{5}P\frac{6}{5}$. Four distinct types of crystals are recognized; one is pyramidal with 2P predominant. The others are prismatic, dome-like, and lath-shaped. The latter came from the Longfellow Mine, and are peculiar for their ortho-diagonal elongation and the large development of the orthodome $P\overline{\infty}$. The axial relation calculated from the measurements of the different types is $a : b : c = .85676 : 1 : .88603$; $\beta = 87°36'36''$——The very rare mineral *pollucite* has just been reported by Wells[25] as associated with quartz crystals aud clay, and with psilomelane and a nearly colorless calcium beryl at Hebron, Maine. The pollucite is in irregular fragments, perfectly colorless, and as brilliant and transparent as plate glass. Its index of refraction for sodium light is 1.5247, and its density = 2.976–2.985. Its analysis gave:

H_2O	SiO_2	Al_2O_3	CaO	Cs_2O	K_2O	Na_2O	Li_2O
1.50	43.51	16.30	.22	36.10	.48	1.68	.05

corresponding to $H_2R'_4Al_4(SiO_3)_9$, with which formula all the analyses of the Elba mineral may likewise be made to agree.——*Columbite*[26] crystals from the Bob Ingersoll Claim and the Etta Mine in the Black Hills have a tabular habit with $\infty P\overline{\infty}$ predominating.——Snow[27] reports the occurrence of *turquoise* at several ancient workings near Silver City, Grant Co., New Mexico.

[21] Ib., Feb., 1891, p. 105.

[22] *Amer. Geol.*, VII., 1891, p. 181.

[23] *Amer. Jour. Sci.*, April, 1891, p. 296.

[24] Ib., p. 300.

[25] Ib., p. 213.

[26] Blake. Ib., May, 1891, p. 403.

[27] Ib., June, 1891, p. 511.

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